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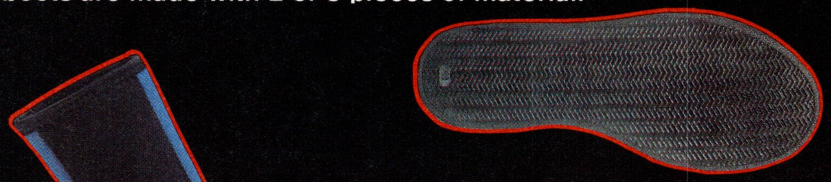

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skin diver
Volume Thirty Number Eleven

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COVER

Divemaster Tom Stansell checks Shari Kurgis' instruments as they decompress at ten feet in clear Bahamian water. Geri Murphy took the photo using a Nikonos III with 15 mm lens and an Oceanic 2001 strobe.

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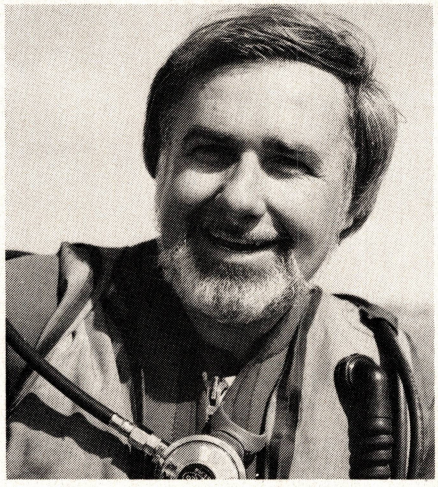
SDM Editorial

BY THE PUBLISHER



DIVING ALONE VS THE BUDDY SYSTEM

The controversy over diving alone has not subsided. If anything, it has grown in size and scope, generating a tremendous ground swell of public opinion. Dick Anderson's buddy diving article in the August, 1980 issue of SDM hit a sensitive nerve and sport divers have not stopped talking about it. Did Anderson's opinions on diving alone stir up unnecessary trouble? Certainly not. His article simply revealed a problem which has been quietly bubbling beneath the calm surface of diving for the last 20 years. Now, many divers are coming out of the closet and freely admitting that they do dive alone on certain occasions.

The buddy diving controversy has divided sport divers into two separate and distinct groups. During a Midwest underwater symposium earlier this year, we were amazed to find the attending divers divided two-thirds in favor of the buddy system and one-third in favor of diving alone. This simple poll revealed a sizeable percentage of people involved in a form of diving which was once considered a terrible taboo. The seminar on buddy diving resulted in more questions than answers and clearly indicated the issue remains unresolved.

The group in favor of buddy diving pointed out that "never dive alone" is the first commandment of dive safety. From the very start of scuba class, students are warned not to enter the water without a partner. Their buddies are supposed to be a combination of surface tender, lifeguard, early warning system, and amiable companion. Inter-dependence among dive buddies becomes a deep-seated concept in the novice divers' minds and hopefully a permanent fixture in their underwater survival procedure. Discussion or sanction of the concept of diving alone could very well undermine all of the basic training conducted by today's instructors. Condoning the right to dive alone could spread confusion and chaos among beginning divers, resulting in unnecessary accidents.

The group in favor of diving alone claims that the buddy diving concept is a charade. It is an archaic, unrealistic procedure which really does not work in open water. They claim that the buddy system has been given a great deal of lip service but relatively little scientific study and that people do not necessarily behave in the way that scuba instructors would like.

Supporters of the buddy system claim that buddy diving has saved thousands of lives and will probably save thousands more in the future. Those opposed to the system point to dive accident statistics that imply that many double or triple fatalities are the direct result of the buddy system.

Buddy diving proponents claim that the buddy system is a universally accepted safety procedure and that it is used by everyone except for perhaps a few radical divers. The opposition says this is not so and that many divers secretly dive on their own, but hide this fact from their peers. They also point out that the buddy system is an arbitrary rule which infringes upon their personal rights and freedoms. In addition to these obvious points of debate, there are many questions and situations which remain ill-defined or totally ignored. For example, how much more hazardous is it to dive alone than to dive with a buddy? No one really knows for sure, as there has been no specific study to provide factual data.

Are there certain situations in which diving alone would be acceptable and permissible? What about the person who drops his sunglasses off the dive boat in 10 feet of water? Is he allowed to retrieve those sunglasses on his own or does he need a buddy? What about the dive instructor who has to go back into the water at the end of the dive because the anchor is stuck under a ledge or in a crevice? How many times have you seen a dive guide retrieve an anchor on his own?

Is the buddy system strictly limited to two divers, or is it permissible for three people to dive together? Wouldn't it be a lot easier for two people to rescue a third diver in case of an accident?

Can a handicapped person be designated as a buddy diver or should this person be accompanied by two other certified divers? These are but a few of the dozens of unanswered questions about the buddy diving system. Perhaps it is time to rewrite the training manuals and incorporate a much more thorough definition of the buddy system and how it can be applied in various dive situations. Could it be that much of the controversy is rooted in misunderstanding and misuse of what could be a good safety system?

It is this magazine's opinion that the buddy system is basically a good safety procedure. It has worked well for hundreds of thousands of divers during the last 30 years, but it could work even better in the future. In this issue, PADI training director, Dennis Graver, offers some new perspectives on the buddy system. Perhaps this will be the first step in clearly defining why the buddy system is important and precisely how it should work. We invite you to send us your questions and comments concerning situations in which the system seems questionable or not fully defined.

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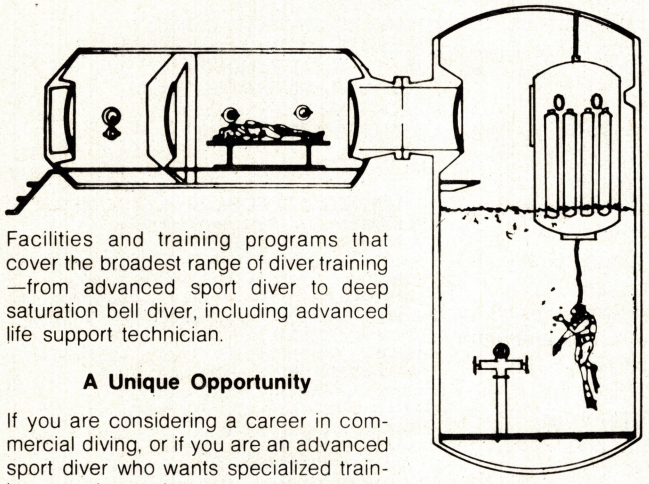

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To be competitive today, a professional bell diver must have a thorough working knowledge of the systems and procedures which support him from the surface as well as underwater training. Emphasis is given to advanced training as a topside life support technician. Classrooms, laboratories and a medical clinic are settings for instruction in advanced gas mixing, analysis, and emergency medical management.

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At the present time, 80% of PDSNY's graduate divers are employed by IUC or IUC International, Inc., and are involved in offshore oil exploration and production, marine inspections, salvage, and submersible operations in Indonesia, the North Sea, the Mediterranean, the Gulf of Mexico, and off the coast of West Africa.

With complete advanced training at the North American Hyperbaric Center, you will have increased your career potential.

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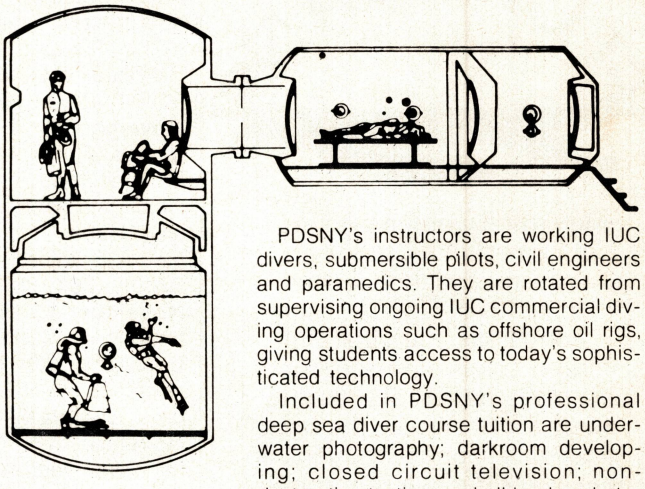
Over 15,000 square feet of classrooms, diving tanks, shops and floating barges comprise the school's facilities on IUC and PDSNY's 7.5 acres at the water's edge on City Island in New York City. Access to Long Island Sound provides student divers with field conditions to sharpen their skills.



PDSNY's instructors are working IUC divers, submersible pilots, civil engineers and paramedics. They are rotated from supervising ongoing IUC commercial diving operations such as offshore oil rigs, giving students access to today's sophisticated technology.

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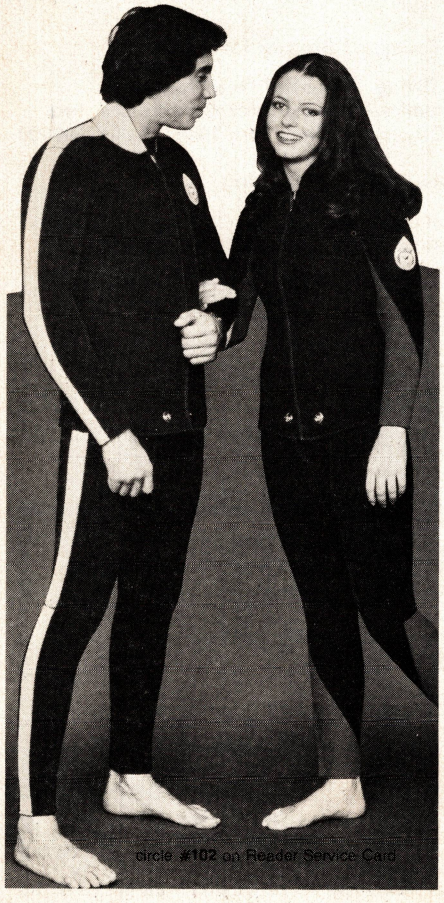

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Diver's Calendar

November 1-6 In-Depth Diving Seminar on Catalina Island, CA. Presentations and practice sessions on advanced dive skills. (Contact: Jon Hardy, Argo Diving Services, P.O. Box 1201, Avalon, CA 90704; (213) 510-2208)

November 7 Fifth Annual Dive New Jersey, Rutgers University. Sponsored by the New Jersey Council of Diving Clubs and hosted by the Rutgers University Scuba Club. (Contact: Joe Pakan, 221 A Bradford Ave., Cedar Grove, NJ 07009; (201) 857-1321)

November 13-15 The twelfth NAUI International Conference on Underwater Education (IQ 12), Toronto, Canada. (Contact: NAUI-Canada, Box 510, Etobicoke, Canada M9C 4V5; (416) 667-3817)

November 14 Gillmen Club Underwater Film Festival, East Catholic High School auditorium, Manchester, CT. Stan Waterman will be the featured speaker. (Contact: Bob Bockholdt, c/o Innerspace Diving Supply, 598 Center St., Manchester, CT 06040)

November 21 The second Southern California Conference on Underwater Education, a NAUI sanctioned program, Orange Coast College, Costa Mesa, CA, 9:00 am to 5:00 pm. Lectures, workshops, exhibits and prize drawings. Admission is $15. (Contact: Susan Bangasser, SoC-Q_2, 12724 Valley View Lane, Redlands, CA 92373)

November 21 The 19th International Photographic Competition and Film Festival, 7:30 pm, Orange Coast College, Costa Mesa, CA. Sponsored by the Los Angeles Chapter of the Underwater Photographic Society. Admission is $5. (Contact: Susan Bangasser, SoC-Q_2 12724 Valley View Lane, Redlands, CA 92373)

December 4 Thirteenth Annual San Diego Council of Divers Awards Banquet. Door prizes, photo contest and unusual entertainment. (Contact: James "Leroux" Redman, P.O. Box 9259, San Diego, CA 92109; (714) 283-3628)

December 4-6 Sports Medicine Conference — Athletes and Health, Ramada Inn, El Rancho Raquet Resort, Sacramento, Calif. Sponsored by the Pacific Physical Therapy & Sports Medicine Center and the Univ. of Calif. San Francisco School of Medicine. (Contact: Extended Programs in Medical Education, UCSF, (415) 921-1800)

January 10-16 The Temple University Underwater Medicine Program, Grand Cayman. Category I course on underwater medicine, physiology and marine toxicology. (Contact: the Office of Continuing Medical Education, Temple University School of Medicine, 3400 North Broad St., Philadelphia, PA 19140)

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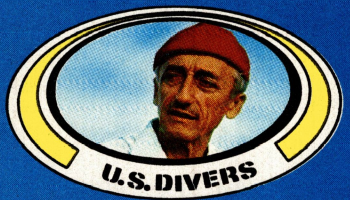

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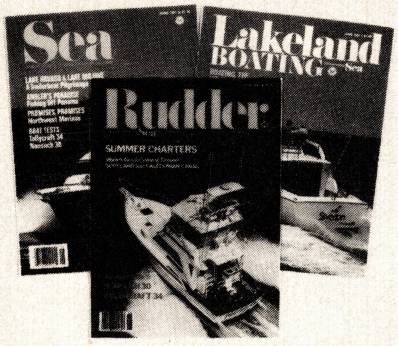

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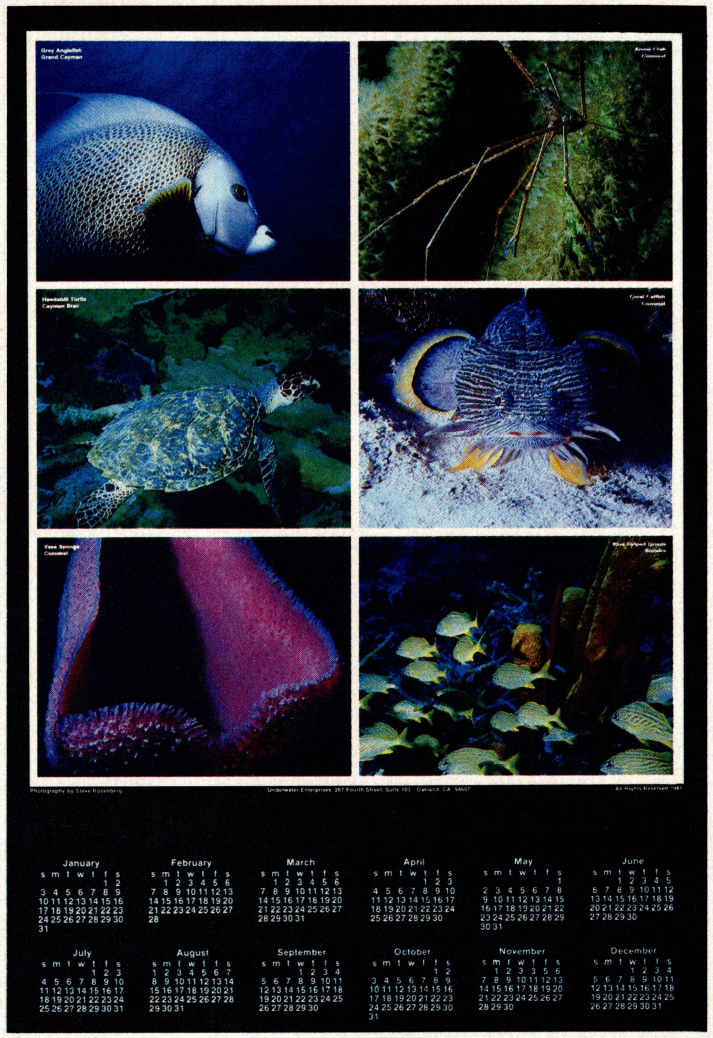

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MARX ATTACKED BY SHARK

Sir Robert Marx, world famous U/W treasure hunter and marine historian, survived an attack by a mako shark this past August 6. He was snorkeling in a remote, uninhabited area of the northern Bahamas, 50 miles west of the Berry Islands, looking for a shipwreck. Marx suffered an unprovoked head-on attack by a mako shark estimated to be more than eight feet long. The wound on Marx's right arm required 150 stitches to close and contained some of the mako's teeth.

Here, in his own words, is a first-hand account of the attack:

"We were on a shallow coral reef about 20 feet deep. I was leading the group, and about 200 feet in front of the skiff . . . I was carrying an Hawaiian sling shaft because we had had a lot of trouble in the past with aggressive 'cuda and sharks. On a number of occasions I had had to bop several sharks and 'cudas to drive them away. No spearfishing activities had taken place on that reef or on that day, nor were there any fishing vessels in the area which might have dumped fish or trash overboard.

"I was on the surface . . . scanning the water from side-to-side, searching for traces of a shipwreck.

"I had a sudden premonition of danger. Ahead, about 75 to 100 feet in front of me, I saw a large, white shark . . . coming straight at me, very fast — like a torpedo. I grasped the spear shaft with both hands, seeing the shark getting larger and larger as it bore down on me! The spear hit the shark right in the middle of its head — pushing me backward with great force. The spear shaft bent like a horseshoe and flipped over my head. I grabbed the shark's snout with my left hand and began beating the creature furiously with the fist of my right hand — trying to keep it from biting me. All this time I was being pushed backward through the water with great speed.

"Somehow the shark managed to grab the biceps of my right arm as I was pounding on its head. But, my battling the shark must have freaked it out and it didn't get a good bite. I guess it took off immediately, but I couldn't tell because my mask had been knocked off and was hanging around my neck. Because my arm was bleeding, I raised it out of the water yelling, 'Shark!' to alert the others. I swam calmly to the skiff, knowing that if I panicked the shark would probably come back. Someone pulled me aboard and quickly put a T-shirt around the wound. We headed for Bimini and called Neal Watson to have him alert the clinic to be ready to patch me up."

Marx has fully recovered from his attack and has resumed his treasure hunting activities.

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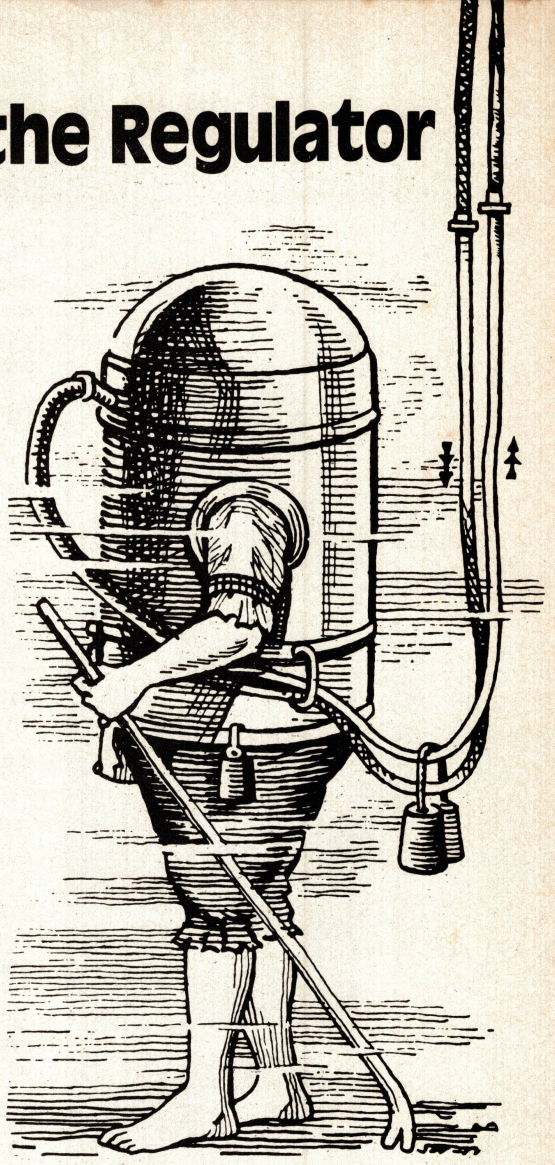
Evolution of the Regulator

BY GEORGE COZENS



Man's desire to descend beneath the water's surface, to experience a brief moment in the underwater world, extends back long before recorded history. What urged the first diver into the water initially is a matter of conjecture: simple curiosity; the search for food; perhaps a military mission. Evidence indicates that diving was practiced more than 5000 years ago — primarily in reasonably shallow waters, and mostly for the collection of food, coral, sponges and mother-of-pearl.

Through the centuries one of the major concerns of divers (that is, besides survival) was how to prolong their stay underwater. Many of the early divers were accomplished free divers (free perhaps, because they were coerced into diving without pay). They started training in breath-hold diving as children, and developed their ability to go deeper and stay longer underwater as they grew into adulthood. Depths of 80 to 100 feet and dive times of one to two minutes were quite common. To improve their efficiency underwater, rocks were used as anchors to speed the diver's descent, and ropes, tied around the diver's waist and hauled up by helpers at the surface, aided the diver's ascent. (Remember, dive fins weren't invented until several thousand years later.)

Even with these techniques a free diver's depth and time underwater could only be pushed so far. Obviously, (to me anyway) there was a need to provide the diver with an underwater air supply. A very early attempt to meet this need appeared sometime around 900 B.C., in the form of a device which delivered air from a reservoir to the diver at ambient (surrounding) pressure (sort of an early-day scuba regulator/tank combination). This simple device, portrayed in a 9th century B.C., Assyrian frieze, consisted of an air-filled breathing bag fashioned from animal skins and carried by the diver. Scuba, however, had not yet arrived. A few problems still remained to be solved. First, the bag was quite buoyant, a problem that could be resolved by the addition of weights. Now, assuming the diver had his buoyancy properly adjusted, and could push the rather large air bag and its compensating weights through the water (recall no fins yet), he had a dismal choice: what to do with the exhaled air? After breathing from the bag he could either exhale into the water (the first form of open circuit scuba), or he could exhale back into the bag (the first form of closed circuit scuba).

Both options had their problems. In the former (exhaling into the water), each succeeding breath would drastically change his buoyancy (negatively), taking him deeper and deeper into the water. Remember, quick release weight-belts and buoyancy compensators hadn't been invented yet either. In the latter (exhaling into the bag), he could maintain his buoyancy by returning the exhausted air to the bag, but this would only work for so long. The diver would experience carbon dioxide buildup after rebreathing his own air a few times. After awhile, the local divers realized this Assyrian air bag was no panacea, so they returned to free diving for a few more centuries.

Undaunted by earlier failures, divers searched for some means to increase their depth and duration. The advent of the breathing tube, or snorkel, was a step in the right direction. The use of such a device was (apparently) first recorded by Aristotle (circa 355 B.C.) — but surely, such a simple thing as this was used much earlier. The first tubes were made of hollow reeds, allowing the user to stay submerged for long periods

(Continued on Page 26)

WHICH IKELITE

There are obviously several superb IKELITE LITES you might consider. Some offer dual beams, rechargeable models, small size, or unmatched intensity — exciting features that can broaden your diving experience. But only you know the features you really need. See these LITES for yourself at the IKELITE dealer nearest you, then savor the experience of being unable to make a bad choice.

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IKELITE II RECHARGEABLE

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MINI C-LITE I

The MINI C-LITE I features compact size (5" long by 3" diameter), a virtually indestructable case, unmatched intensity, and easy one hand ON/OFF control. Designed to operate with 4 "C" cell alkaline batteries (not included) and a standard flashlight bulb. This combination provides 4 to 6 hours of light with twice the intensity and coverage of similar size lights. The lite's size and optional rubber holster (#1056) offer unlimited mounting applications. Lite is available in black, clear or orange.

MINI C-LITE II RECHARGEABLE

This new lite offers the same features as the MINI C-LITE I, plus 4 "C" cell nickel-cadmium batteries and charger. The ni-cad batteries provide a constant intensity for approximately 2 hours on a full charge and recharge in 12 to 16 hours. Optional rubber holster (#1056) also available.

C-LITE I

The unique shape of these lites offers easy one hand operation, or they can be carried on dives in the optional (#1055) C-LITE HOLSTER. The C-LITE I offers 50% greater intensity than lantern battery powered lights. The sealed beam bulb operates from 6 "C" cell alkaline batteries (not included) and produces 10,000 initial candle power as compared to 6,000 candle power produced from standard lantern battery powered lights.

C-LITE II

One of the brightest rechargeable lights in the diving industry. This lite comes complete with ni-cad batteries, charger and halogen bulb. The special ni-cad batteries provide approximately 1½ hours of constant intensity between charges. Lite fits optional (#1055) C-LITE HOLSTER.

MODULAR I LITE

This lite utilizes six inexpensive "D" cell flashlight batteries (not included) to provide intensity unequalled by any popular priced diving light. Lite can be converted to Modular X, SuperLite or MovieLite. Available in black or clear.

MODULAR X LITE

This lite utilizes a more powerful bulb which requires six alkaline "D" cell batteries. This combination produces an intensity almost equal to rechargeable lights in the $100 price range. Lite can be converted to SuperLite or MovieLite. Available in black or clear.

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IS THE BEST ?

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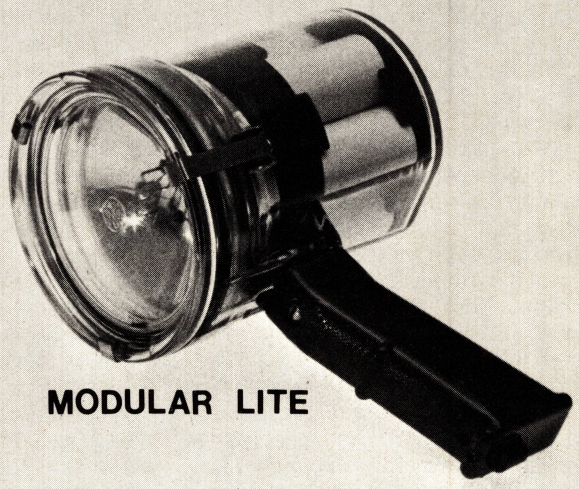
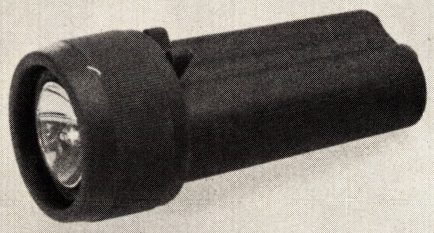


MODULAR LITE



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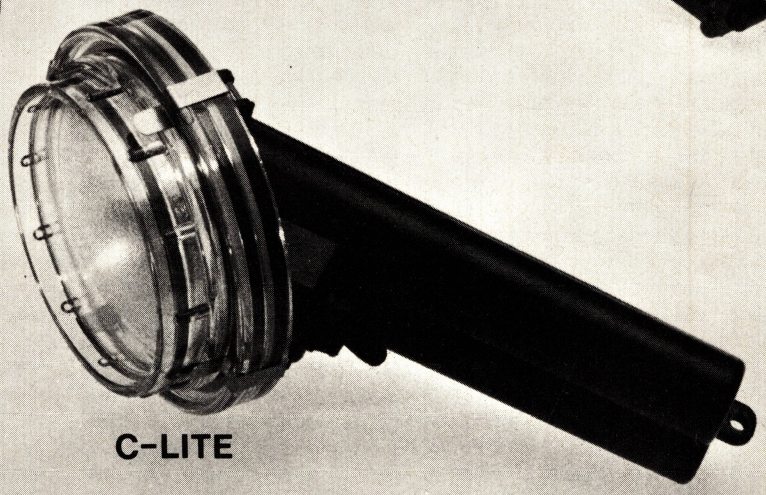

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VIKING SUIT

A different approach to Constant Volume suit design

By Jim Walker

PPC staff photos/Ron Williams

In every cold-water entry there's that initial moment when, regardless of the number of neoprene layers covering your body, that icy seepage crawls down your neck and sneaks into the zippers and seams of your protective garments. For a moment your breath comes in gasps and you hoot through your snorkel as you try to walk on water.

Although this uncomfortable feeling will soon pass, you know it's only a matter of time until the last of your spare body heat is lost to the water — usually sooner than you would have liked. These difficulties are just accepted as part of diving with a wetsuit. Naturally, if you could keep the water out of your outfit, these problems could be avoided.

The drysuit is an old idea that, owing to improved technology, is gaining popularity. While a number of drysuits are available to today's sport diver, there is one with a difference — the Viking Sport.

The major difference between the Viking Sport and other drysuits lies in the base material. While other suits are foam neoprene (as are wetsuits) the Viking Sport is made of rubber backed by a velourized polyester tricot fabric. The rubber provides the waterproofing but no insulation. The diver wears clothing under the suit to keep warm. The thickness of these undergarments can vary with the water temperature expected. For especially cold water, Viking offers a jumpsuit made of 10 mm thick polyester foam, lined on two sides with nylon. This thermal underwear can be worn over a pair of long cotton underwear.

The design of the Viking suit has a number of advantages. Neoprene compresses at depth, becoming thinner and providing less insulation. The Viking, however, relies upon the air inside it and, especially, the undergarments, to keep you warm. As the air in the suit is compressed at depth and the suit begins to cling, you merely add air into it until comfortable.

The rubber surface of the Viking Sport is smooth and not likely to snag on rocks and other sharp objects. It is also easy to clean. The fabric-reinforced rubber doesn't stretch easily and won't balloon when air is added to the suit. The suit material is thinner than neoprene and takes up less space when rolled up. The entire suit fits into a carrying bag the size of the average knapsack (eight inches in diameter and 24 inches long).

Any suit is only as waterproof as its seams and seals. The seams of the Viking Sport are sewn and then vulcanized under a rubber tape, making the whole suit basically one piece of rubber. This provides not only waterproofing but strength.

There are only four openings in the Viking Sport: the neck, each wrist and the back zipper. The boots are attached to the suit and are of the same material, only reinforced and bonded to a tough rubber sole complete with molded tread. A double layer of suit material runs from the toe of the boot to above the knee, providing added wear protection along the front of the shin and knee.

The wrists of the suit are sealed by stretchy latex cuffs. These are cemented to the arms under rubber tape but can be easily replaced if damaged. The neck or collar of the suit is a tapered latex tube. The tube can be trimmed as necessary for different neck sizes. This is important as excess pressure around the neck, even if bearable, can have adverse effects on a diver. Trimming the tapered neck tube should be done carefully to avoid accidentally over-enlarging it. The latex collar is surrounded by a latex hood and both are attached to the suit in the manner of the cuffs.

You don the Viking Sport through a heavy metal zipper on the back of the suit at the shoulders. When closed, the zipper is watertight.

The Viking suit can be easily adjusted for buoyancy and insulation by adding or venting air. Air is added by a power inflator. A low pressure hose (provided with the suit) connects the regulator first stage to a valve on the left breast of the suit, allowing you to add air when this valve is pressed. Another valve, on the upper left arm, releases air from the suit. The outlet can be adjusted to maintain a desired internal pressure. Thus, when air expands in the suit during ascent, it vents automatically.

On my dives with the Viking Sport, I used my normal gear, including large vented fins and a BC jacket. Although I expected to have trouble putting the fins on over the suit's attached booties, this did not happen. I merely had to lengthen the fin straps to accommodate the booties. I found that the boots were somewhat cramped in my normal fins but not uncomfortably so. The soles of the boots actually stuck out beyond the fin straps, but this helped hold the fins in place. I never had any trouble with fins slipping off.

The Viking Sport was easier to put on than a wetsuit. I stepped into the suit, pulled the neck and hood over my head and had my buddy zip me in. I finished

The Viking Sport drysuit combines a tough, waterproof outer garment (entered by the zipper on the back) with insulating underwear to maximize diver warmth and comfort.

gearing up, added a little air to the suit, filled my BC (back-up) and jumped in as usual.

In the water I found descending to be simply a matter of releasing the air from the BC and suit. After this, I could descend feet first or head first. I could check my descent by adding air to the suit.

Adjusting for neutral buoyancy was no trouble. I used the same amount of weight as with my quarter-inch farmer john wetsuit. (The amount of weight used with the Viking Sport will vary with the

The inflator valve (on chest) and the adjustable vent (on arm) control suit volume.

thickness of the undergarments worn.) As depth and pressure increased, adding a little air would keep me comfortable and neutral. I found the pressure relief valve operated nicely. Depending on its adjustment, it would vent excess air in only a few feet of ascent.

I found that even when I removed my fins, I could orient myself and swim underwater in full gear with only slightly more difficulty than when similarly outfitted in a wetsuit.

While returning to the surface I could remain neutrally buoyant and swim up, or float up gradually venting excess air. The rate of ascent can be controlled by raising or lowering the left arm and attached outlet valve. At the surface, either the suit, BC or both could be used for flotation.

Remaining warm and comfortable was no problem. I found the thermal underwear unnecessary at the water temperatures in which I dove — 60-70°F. I just wore long pants, socks and a sweatshirt.

There are a few points to note about the Viking Sport:

If an emergency required ditching the tank, the diver must remember to detach the power inflator hose from the suit. I was reminded of this each time I removed my tank after a dive.

Underwater, air inside the suit will gather at the highest point. As the diver changes positions this air will shift. This is not a problem, just a different feeling from a wetsuit.

I found that if either of my wrists was the highest point on my suit, air would vent out somewhat and a few drops of water could enter. This can be remedied

(Continued from Page 101)

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Rx FOR DIVERS

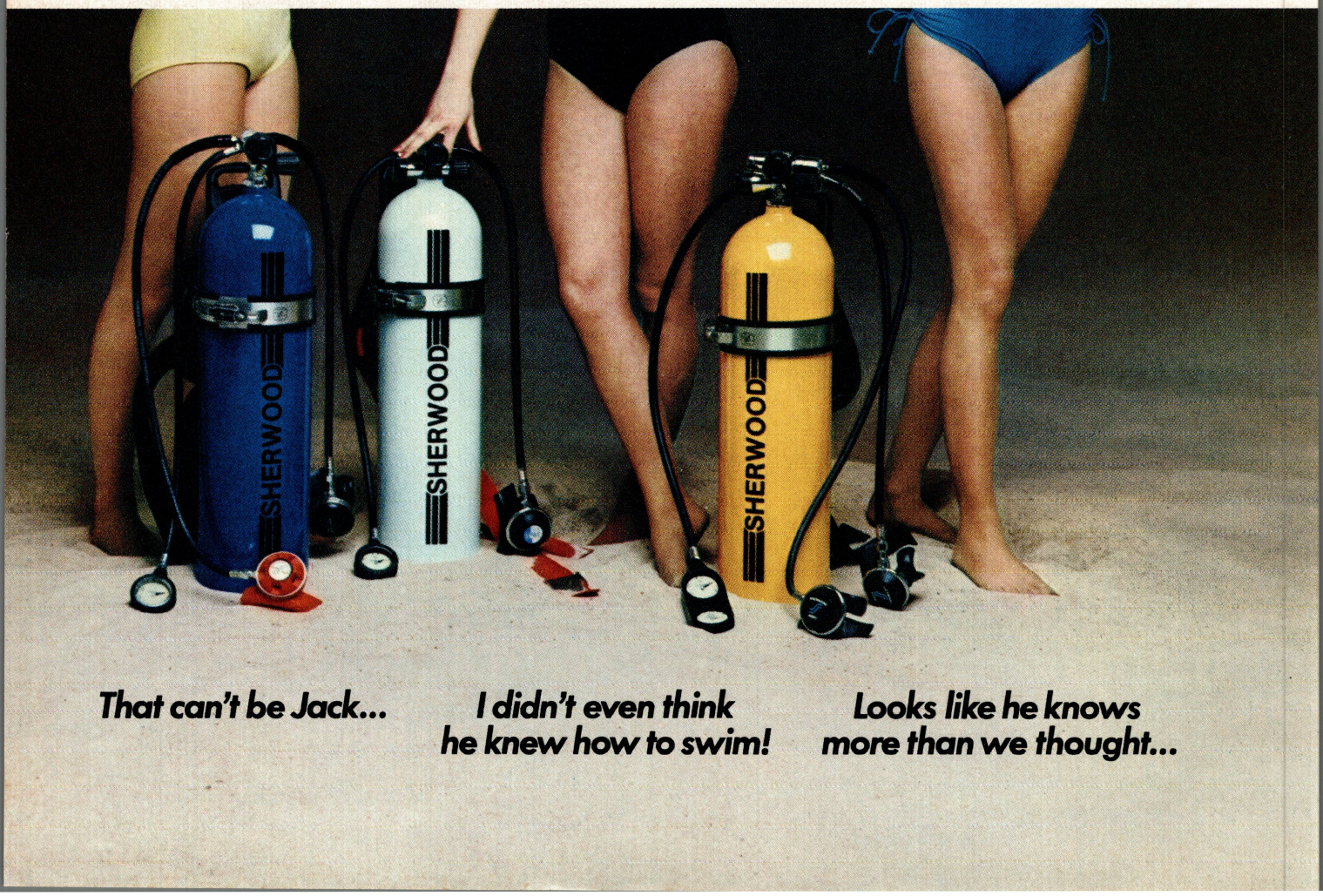
BY CHARLES V. BROWN, M.D.

COPING WITH SEA SICKNESS

As a child I got car sick. Much later, when the aircraft carrier gyrated in heavy seas off Cape Hatteras, I got seasick. Like most sailors, I got over it and with the peculiar cruelty of recovered victims, laughed when soldiers we ferried home from Europe tossed their cookies. After years of landlubbing I discovered diving and returned to the sea — and its curse to me. Usually first in the water and last out, I was thought a most avid diver. Actually I was trying to escape sea sickness. Our mail indicates that the problem is widespread, with snorkelers not exempt. There's no shame. The legendary Captain Horatio Hornblower had to lean over the rail whenever his frigate challenged the bounding main. Sufficiently provoked, even fish get seasick.

Seasickness, like any motion sickness, has two components. There's the symptom complex of nausea, salivation, cold sweat, pallor, weakness and the feeling that you'd rather be dead. And then there's vomiting. This is accomplished by a series of reflexes that close the epiglottis to guard the windpipe, elevate the soft palate to block the nostrils, open the sphincter valves of the stomach and esophagus, and contract the diaphragm and abdominal wall muscles. It's orchestrated by a group of nerve cells in the brain called the vomiting center.

Why motion sickness should occur is a mystery. It seems to serve no useful purpose except maybe to keep people off of dangerous conveyances. How it comes about has been extensively researched, but is still only partly understood. The name itself is misleading



since it's not motion but change in motion that brings us to grief. Change in motion is acceleration. It occurs in a straight line or about any of three axes which define the rotational movements of pitch, roll and yaw.

We sense accelerations through several modalities. The most important are vision, the vestibular organs (saccule, utricle, and semicircular canals) in the inner ear, and the proprioceptor nerve endings which respond to distortions in skin, tendons, and various organs. Motion sickness is most likely when the information these modalities convey to the brain is conflicting. For example, an old Chinese torture was to make a prisoner watch rotating spirals while strapped in a stationary seat. A modern masochism is to watch a movie that gives the impression of a roller-coaster negotiating hills and curves at breakneck speed. In each case the eye reports rapidly changing motion while the vestibule and proprioceptors insist that nothing is happening.

About 40 percent of airline passengers feel nausea when acceleration in the up and down direction is between .2 and .4 times the force of gravity, a condition of heavy turbulence. In this case the vestibular organs and the seat of the pants faithfully report the ups and downs while the eyes, seeing only the plane's interior, report no motion. A person on a boat is told by his vestibule and proprioceptors that he's swinging to and fro, side to side, and right to left as well as moving up and down. But again, since his visual frame of reference (the boat) is moving in the same way, his eyes deny it. That doesn't compute and the frustration somehow makes him sick.

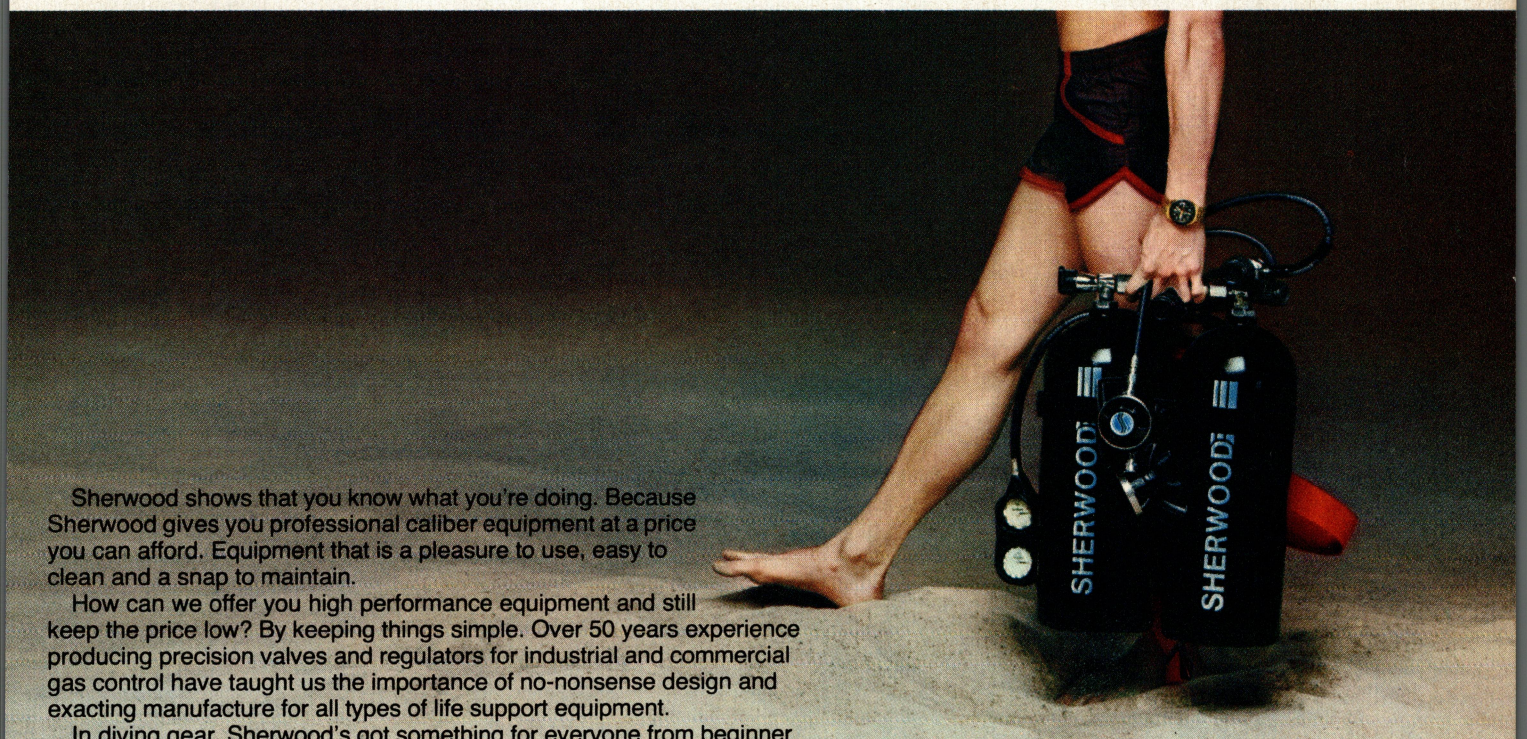
How best to thwart seasickness is controversial. Whenever 100 cures are touted, you can be sure that none are really great. Empty and full stomach, soda crackers, various potions and thinking happy thoughts all have their proponents. Dr. Donahue, a syndicated newspaper oracle, says be well rested, don't eat heavily, don't imbibe, don't smoke, do focus your eyes on things within your frame of reference(?) and try to nap. Some find a cigarette relaxing and a bit of booze comforting, though of course we can't condone either before diving. The crew of the dive boat *Coral Sea* ran their own test and decided that hard candy and vitamin C were protective.

Our own strategy is three-pronged, combining scientific, psychological and empirical approaches. The scientific angle is to minimize sensory input that triggers nausea. Park yourself at the boat's center of buoyancy, where accelerations are least. Face in the direction of greatest motion so you'll experience more pitch and less roll or yaw. This seems helpful, possibly because years of riding in cars has acclimatized us more to pitch. To exclude noxious input from consciousness lie down, shut your eyes, and let the cradle of the deep rock you to sleep. Or go out on deck and watch the horizon; use your sea legs to compensate for movements so your head rides even keeled.

Offending sensory input can be partially blocked with drugs. Combinations of amphetamine with scopolamine or phenergan have proven very effective, but these drugs cause performance decrements and favor heart rhythm disturbances, so can't be recommended before diving. Less effective but safer agents are Bonine, Marezine and Dramamine. For best results they should be taken an hour or two before diving. They cause drowsiness, dry mouth, and blurred vision in some, so should be tested out first on non-diving days. Some suggest starting them the night before to allow time to adapt to side effects, but it's uncertain whether this will also reduce the antinauseant effect. Some drugs (Compazine, etc.) are commonly prescribed for nausea of other causes. These have side effects potentially detrimental in diving, and should be avoided.

The psychological approach starts with encouragement and reassurance. Those who through no personal merit are

(Continued on page 22)



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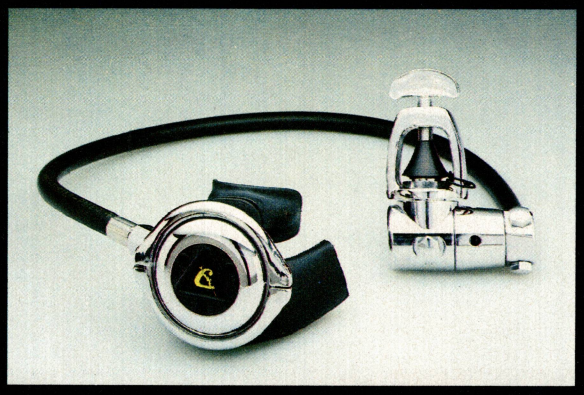

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SHARK SUIT MEETS JAWS

Photos/Ron Taylor

The Taylors Give Their Anti-Shark Suit The ULTIMATE TEST

By Valerie Taylor

In October's SDM, Valerie Taylor described the anti-shark armor her husband, Ron, helped develop and their adventures testing it in the Coral Sea against whitetip and gray reef sharks. In this issue she relates how the suit held up in its ultimate test: An encounter with the dreaded great white shark.

In January 1981, Ron, myself and our nephew, Mark Heighes, traveled to South Australia hoping for the chance to test our anti-shark armor against the immortal great white shark.

Because of the immense size and power of great whites, we knew the problem would be that the predator could possibly carry away a person wearing the suit. Also, great whites have far more crushing power in their jaws than other smaller sharks. We planned to use dummies inside our suits for the initial tests. The risk of using a human, when so little is known about the pressure these great predators apply, would be foolhardy to the point of stupidity.

We made a life-size dummy by stuffing an old wetsuit with rags and seaweed. He was a very floppy fellow, but we figured the mesh suit would hold him together. These events took place at Dangerous Reef. There was chum in the water but none attached to the dummy. It was our fifth day of trying to attract a shark. The weather, always difficult, was being more unkind than usual.

26th January, 1981 – 11:15 am: The weather is worsening rapidly and we fear that the trip will be a failure due to unworkable conditions and lack of sharks. A Canadian diver has been out here shooting sea lions and using them to attract great whites. We know he has killed several sharks and removed their teeth, which could be the reason for their scarcity. Things are going very poorly for us. Mark is posted as lookout on the cabin roof, while we adults huddle inside away from the rain and cold, reading. Five days without refrigeration has not enhanced the smell of our baits very much and they are becoming difficult to live with. . . . Valerie's Diary

Later: Well, the shark came with a tremendous rush, snatched a bait, then dove with a great flapping of his tail and showers of drenching spray. We were all on the deck in seconds, shouting and running around. Mark and I hurriedly began preparing the dummy, struggling to pull the mesh suit over its floppy body. Ron's idea about using seaweed wasn't, in retrospect, a good one. The stuff had turned into a sort of jellied slime. Anyway, with a lot of pushing and pulling we managed to get the dummy dressed, but not before the shark had returned twice, once leaping from the water like a mako — not a common great white practice.

It was a good active shark, a male, about 14 feet long — the average size for this area. Dick Leach, our skipper, secured the dummy to the boat with steel wire trace. A necessary precaution, lest the shark swim away with our valuable mesh suit. While Ron filmed, Mark and I hoisted our floppy creation into the water. He floated almost lifelike, silver mesh glinting in a gray oily sea. I felt he looked lonely drifting and waiting, his T-shirt face gazing mutely skyward. We all watched expectantly. The shark didn't come. We waited: Ron and Mark with movie cameras ready.

It was deceptively peaceful with the water lapping and gulls calling. Sudden-

ly, quite unexpectedly, the shark burst from the stillness, spray flying, sending the cameramen running away. Salt water and movie cameras are not compatible. We would rather miss a shot than allow salt water to spray on the lens — time is lost while the water is wiped away.

Ron yelled, "Coming, it's coming, shoot Mark, shoot!" A great conical head rose vertically from the sea, eyes black as bottomless pits, great maw, a gaping hole. Without hesitation, the awesome fish swallowed the dummy's head, paused a moment, then dove. The oily surface boiled and heaved. A huge fin protruded above the surface, black as night. The dummy appeared briefly, visible through the turbulence. Dick pulled on the trace as it strained against the rails. It whipped through the water, slackened, then coiled back as the fish surfaced with tremendous speed. The dummy's limbs flapped doll-like for a second, then beast and dummy were gone in a swirl of foam. The trace pulled taut straining against the stern, then slackened. We were stunned by the attack. Of the hundreds of great whites we have worked with, this was by far the most aggressive.

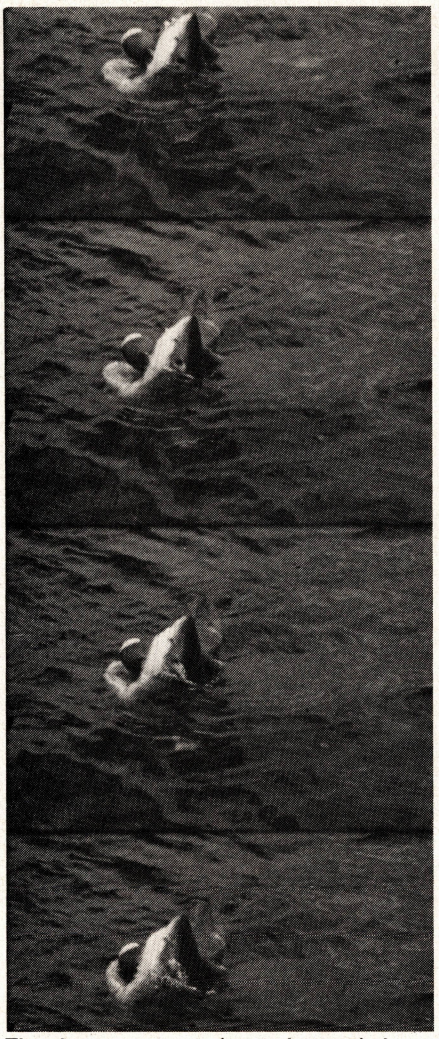
We feared our dummy would be torn to pieces. The trace had tangled around the propeller and took some minutes to release but when we pulled the dummy aboard, he was intact. Not only that, the teeth had not penetrated the mesh. It seemed incredible.

We waited for the shark's return until rain drove us inside. We waited inside until the strengthening wind penetrated our precarious lee and drove us in a sort of mild panic from Dangerous Reef.

The shark suit experiments at Dangerous Reef have, so far, produced rather unexpected results. None of us had ever before seen a great white so agitated Ron felt it could have been due to an electromagnetic field generated between the steel suit and metal boat, a theory we have previously considered when working with other shark species. We plan further testing using dummies and white sharks.

Ron is now working on a method of checking the pressure of the shark's bite against the dummy by using hard plastic pipes, instead of seaweed, as stuffing. He also has several other experiments in mind, all of which will have to wait until the next Australian summer and accompanying good dive conditions so necessary for our work.

To me, one of the most interesting aspects of the shark suit experiments is the different methods of attack used by different species. Never before has a human being had the opportunity to sit quietly and observe sharks trying to eat her. I find it a fascinating experience. The following are my observations only and not necessarily scientific facts:



The above sequence (top to bottom) shows a 14 foot great white shark attacking a dummy designed to resemble a diver. The dummy, a stuffed wetsuit, was protected by the steel mesh and was not damaged.

Oceanic blue sharks simply swim up and without any preliminary fuss, bite. It is quite a casual action and only dangerous if the diver does not see them approaching. Oceanic white tips bump first, usually several times, then if there is no retaliation, they bite. Like the blue, it seems a casual act without undue haste or activity. Both sharks have triangular, saw-shaped teeth capable of inflicting terrible wounds. I have never seen either of these species frenzy though I have frequently worked in water where they are common.

Carcharhinids, which include all whalers, are generally much more hesitant, swimming around in an agitated fashion while trying to decide on a course of action. They gather courage from each other and, dog-like, become braver with the larger packs, making aggressive passes at close range, until one braver than the others attacks. The hit is fast and vicious, however, if the victim reacts with aggression before the other, more hesitant sharks fall into a similar attack pattern, there is a good chance of keeping the pack at bay. However, carcharhinids have unstable natures and must be treated with great caution, particularly when the area is baited.

Gray nurse sharks, in their natural state, belie their fearsome, but undeserved reputation. Normally, gentle and slow moving, they are capable of surprising speed and agility. They wanted nothing to do with us or the suit, preferring flight to aggression at all times. Perhaps this was just as well, because the teeth of a gray nurse are so pointed there could be a danger of them penetrating the steel rings and forcing the links apart.

Wobbegongs were also reluctant biters. Being in close proximity to the mesh seemed to disturb them. Our early experiments with wobbegongs resulted in Ron's theory of an electromagnetic field. Past experience has taught us that wobbegongs have nasty tempers and are rather inclined to bite if annoyed. They have bitten more Australian divers than any other species of shark. Their lack of aggression toward us when we annoyed them extensively came as a surprise. It seemed they disliked divers wearing the suit but were still quite happy to bite one that wasn't.

Tigers have a confident behavior around bait that, from a diver's point of view is deceptively casual. Although we have not as yet tested the suit against tigers, we feel they would bite without hesitation.

We have proved that unless in a mindless frenzy, sharks have a tendency to be careful of their teeth, preferring to withdraw them carefully rather than risk breaking them off. With the exception of the wobbegong, whose teeth have no cutting edge, all the sharks we have coaxed into biting, either on ourselves or a bait, gripped with their narrow, in-curving bottom teeth first. Once a firm hold was established, they shook their bodies vigorously from side to side, enabling their serrated, triangular top teeth to saw through the bait with great efficiency.

Ron and I believe we have discovered a very up-to-date use for an old idea. Mail has been around for hundreds of years, and until the invention of the brass bow was very successful in repelling knife-edged weapons. Where once it protected men against each other's aggression, now it can protect man against not only sharks but many other potentially dangerous creatures and situations.

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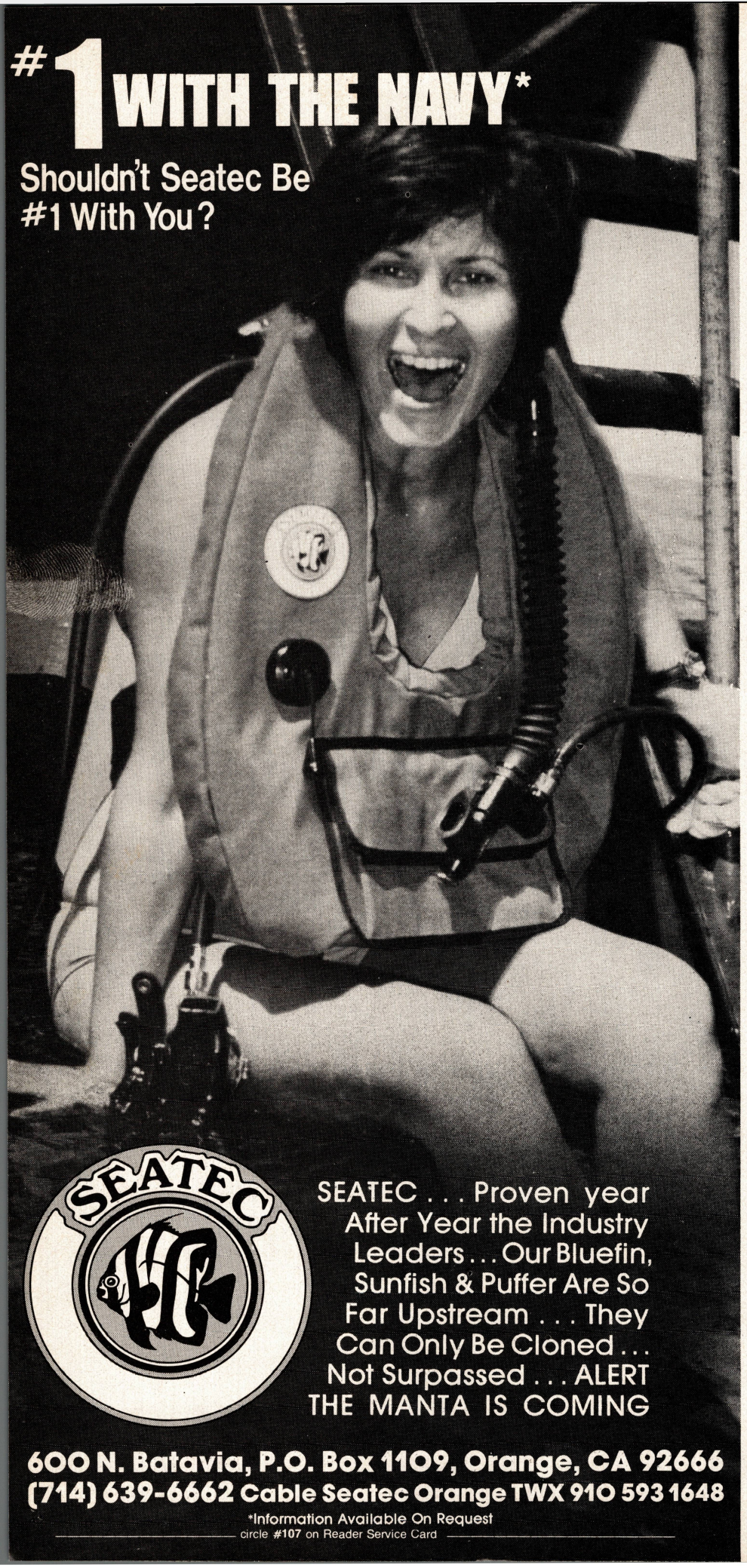

RX FOR DIVERS

(Continued from page 17)

less prone to *mal de mer* should desist from chortling at the queasy, and be supportive. You potential victims want a positive attitude — you're going to do fine. But if the flesh does prove weaker than the spirit, keep it to yourselves. This is no time for group therapy, because seasickness is very contagious. One man heaves within sight and smell of others, and there goes the neighborhood.

Diversion is very helpful. The wind in your face in the prow as you thread the Straits of Magellan, repel the pirates, or sink the enemy submarine can banish nausea. Any activity in which you're physically and mentally caught up is good. Best, drive the boat. You'll be too busy to be sick.

The empirical approach is simply to do whatever you've found by experience is helpful, be it sucking your thumb or listening to music. Many find a light carbohydrate or protein meal protective, while a greasy mess is poorly tolerated. Finally, count on habituation. Starting with short, calm trips and progressing to longer, rougher ones is the way to go. Exposed gradually, the human organism can adapt to almost anything, so much so that Hong Kong's boat people get seasick only when they venture ashore.

Many personal and environmental factors can combine with the movements of the boat to nauseate divers who ordinarily don't get sick. A partial list would include over-distension of the stomach (eating like a pig), gastritis from alcohol or excess acid brought on by certain foods or nervous tension, inner ear disorders, offensive odors, carbon monoxide and other poisons, various drugs, various illnesses and pregnancy.

Nausea endangers the diver. On the boat, it tempts a precipitous water entry without adequate preparation. In the water it turns one's attention inward, away from the environment. It reduces one's ability to recognize and cope with problems. Vomitus can be sucked into the lungs or clog one's regulator. It might chum sharks, and will surely spook one's buddy.

The prudent diver who feels sick will stay dry. If nausea begins underwater, he'll get dry. If his vomiting center won't wait, he has two options. He can puke through his regulator, which is safe provided that no chunks large enough to block the exhaust port valves come up, or he can remove the regulator and replace it after vomiting. Either way, he must be certain to purge it before taking another breath. The lung doesn't take kindly to food or sea water.

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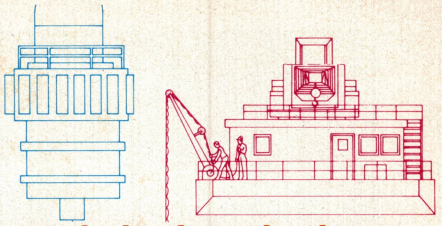

C.D.C. is an integral part of one of the world's largest diving contractors... Oceaneering International, Inc., which is C.D.C.'s parent company and which has three out of five of the major deep water contracts, and the majority of the largest underwater exploration, construction, and maintenance projects. O.I. is heavily involved in over one-third of the world's drilling rigs.

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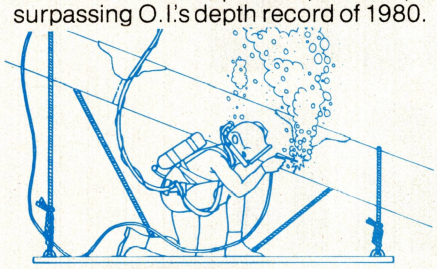

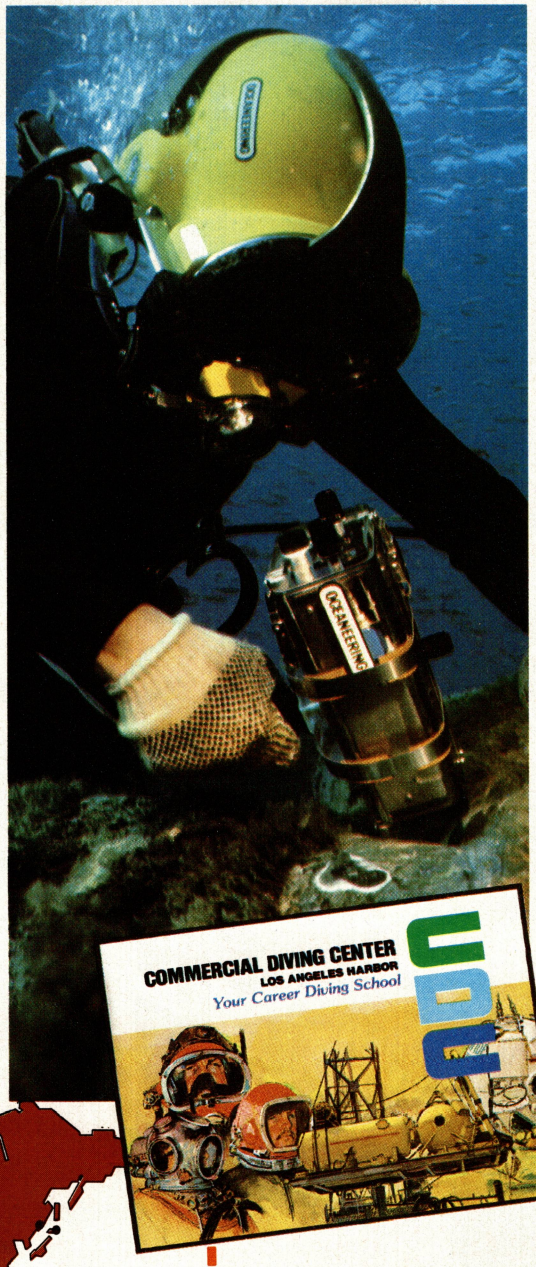

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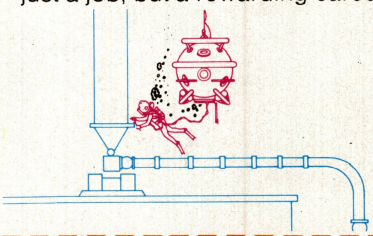

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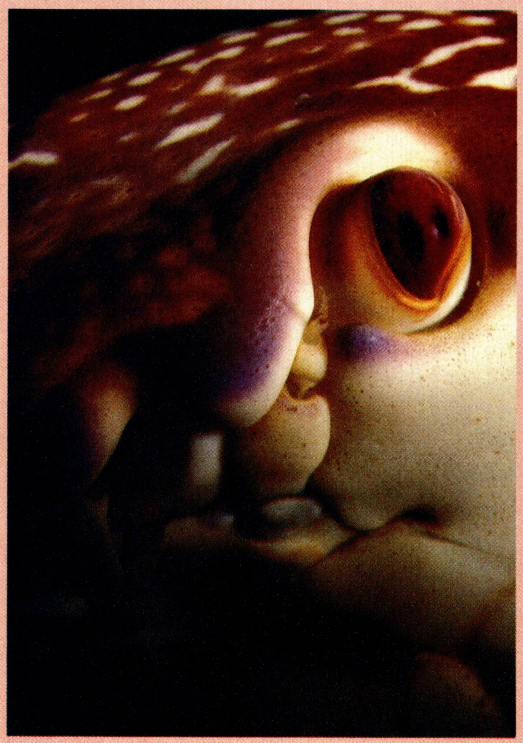


The CORAL CRAB

Colorful Crustacean Makes Ideal Closeup Subject

Text and photography by Geri Murphy

The coral crab's red eye is set on a stubby yellow stalk. These colors are enhanced by the tint of lavender edging the carapace at the eye.

The coral crab is considered one of the prettiest crustaceans in the Caribbean. Its bright red and yellow coloring often catches the diver's eye, because it offers such a contrast to the surrounding blues, purples and greens. The delight of the underwater photographer, it is an ideal model for close-up work and a highly desirable subject for anyone's marine photo collection.

The coral crab is a common species found in the Caribbean, with a wide geographic range from the Bahamas to Brazil. It is one of the largest West Indian crabs, attaining a body size of more than six inches. The upper surface of the carapace is red-brown in color with tiny, bright red dots and slightly larger irregular splotches of white and yellow. The underside is a pale yellow. There is also a light shade of lavender along the outer edges of the top shell around the eyes and at the joints of the legs and claws. It is this subtle tinge of purple which gives the coral crab such an attractive and exciting color design.

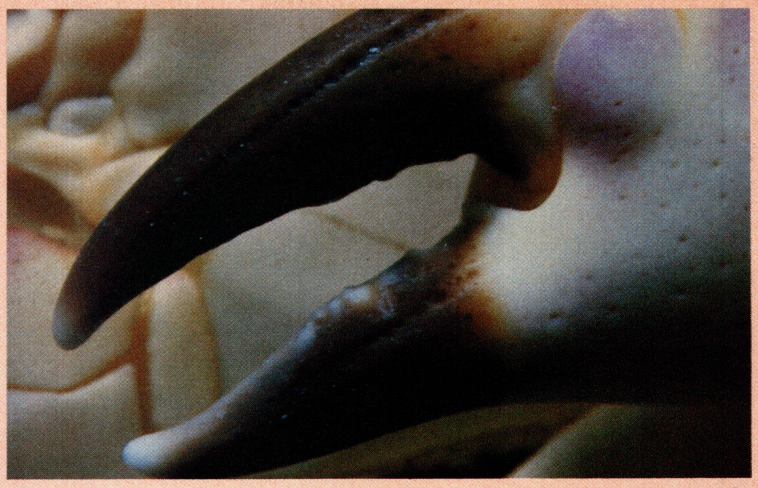
The carapace of the coral crab is somewhat oval in shape and the surface is smooth. The eyes are a coral-red color and set onto short, stubby yellow stalks.

The coral crab has five pairs of legs. The first pair consists of two large and powerful front pincer-like claws, used for crushing food and for defense. The right crusher claw is designed specifically for breaking open small clams, mussels and other bivalves. The left claw is for cutting or tearing — designed for removing small bits of meat from a shell or sea urchin. The other four pairs of legs are slender but strong appendages designed for walking, climbing and clinging.

The coral crab lives on comparatively shallow coral reefs in depths ranging from 10 to 40 feet. During the day, the coral crab keeps a low profile by retreating inside a crevice or cave. A nocturnal feeder, the coral crab comes out onto the reef at night to search for food. Its diet consists basically of sea urchins, file shells, mussels, oysters and clams.

The greatest enemy of the coral crab is man. Caribbean islanders frequently eat them. Other enemies of the coral crab include such predators as the octopus, grouper and moray eel.

The next time you're diving in the Caribbean on a shallow reef, take a closer look under some of those ledges and crevices. You will probably find the coral crab there — and it is a beauty.



Top, the left claw of the coral crab is adapted to removing pieces of food from the bivalves and urchins the crab feeds on. Bottom, the right claw is heavier and better suited to crushing these shelled animals. Middle, the crab can attain a body length of over six inches. It is rarely found in the open during the day.

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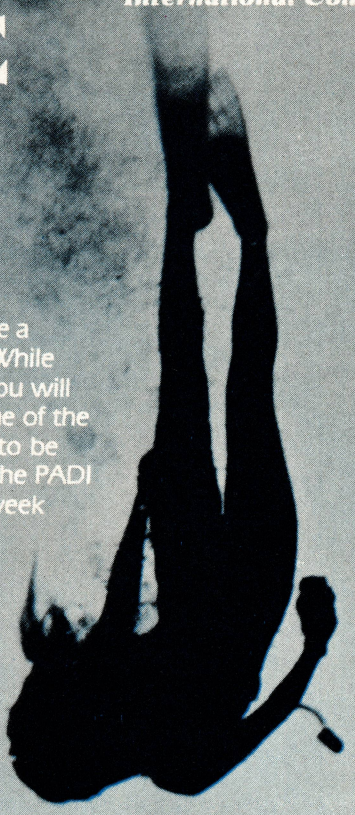

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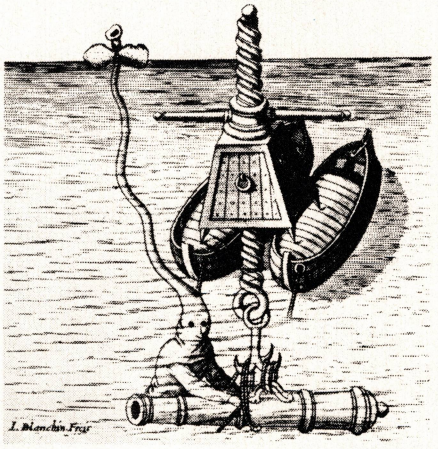
EVOLUTION

(Continued from Page 11)

of time, but at very shallow depths. Indeed, most of the historical applications of these breathing tubes involved soldiers (not necessarily divers) who used them to remain submerged underwater while they approached, undetected, an enemy ship or installation. The next step in the evolution was to use longer and longer snorkels in order to permit deeper and deeper diving. As you might guess, this innovation did not meet with much success. It appears that for many centuries the effect of water pressure on the body was not fully understood — especially the fact that air supplied to the lungs must be close to the pressure on the outside of the body. If the air pressure in the lungs is much less than the external pressure, the lungs cannot be inflated. For example, when using a snorkel, air is inhaled at surface pressure, but the chest experiences additional, external pressure owing to the weight of the water. In a depth of about 12 inches, water pressure (only about 0.45 psi) exerts a total force on the diver's chest of almost 200 pounds, like trying to breathe with someone standing on your chest! And, of course, this external



water pressure increases with depth, making it virtually impossible to breathe through a snorkel at depths much beyond a foot or two. This fact can be easily verified by experimenting for a few minutes in the water with an extra long snorkel, or short length of garden hose (be sure to try this in very shallow water, we don't want to lose any readers) but it took early divers and designers several more centuries to reach the same conclusions.

As late as 1511 A.D., a long snorkel-like device was on the drawing board. This one consisted of a leather bag, or hood, which fitted over the diver's head, and was connected to a long flexible tube

(Continued on Page 78)

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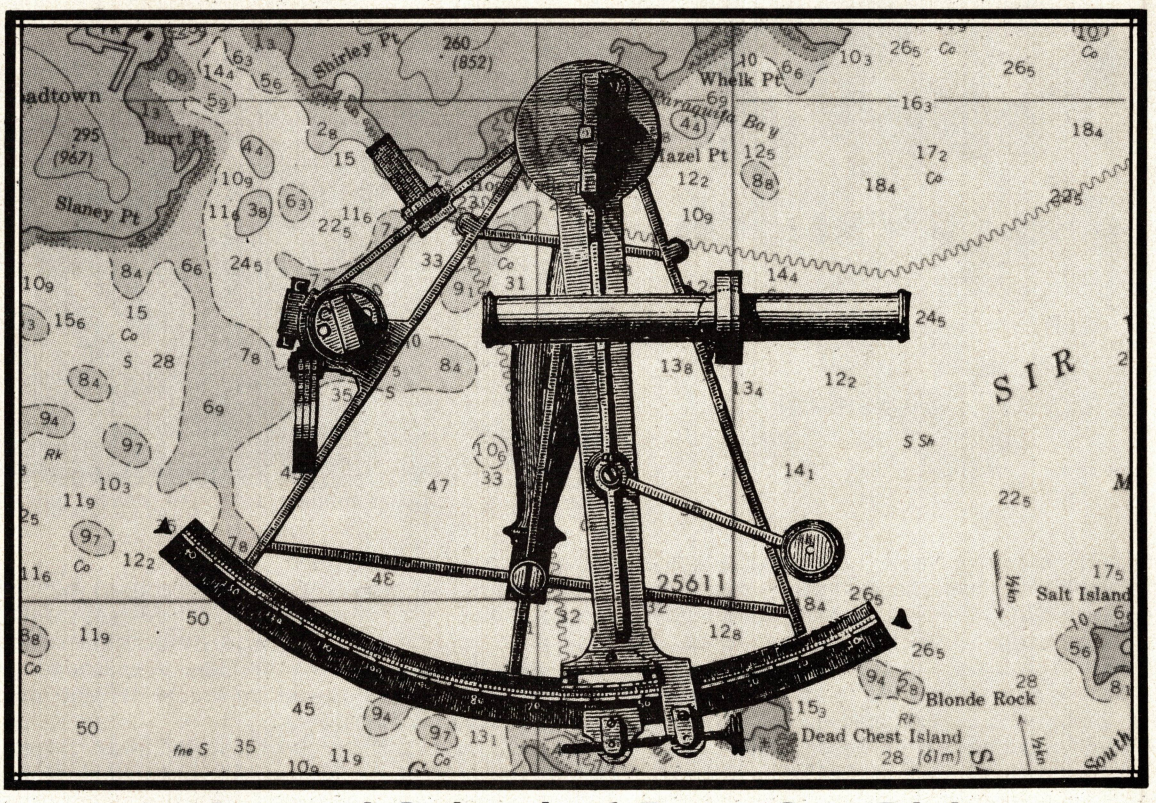

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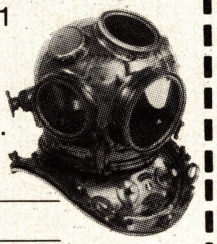

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SAGA OF THE U-352

The Unluckiest Sub

BY MICHAEL T. DICKERSON

photo/Bill Muney

The *U-352's* encrusted conning tower and forward gun mount.

It is May 9, 1942. The crew of a Nazi U-boat stands at battle stations while the sun sinks over a nearby hostile shore. Only 26 miles off the coast of North Carolina, the sub's commander peers through his periscope at what he believes to be an American merchant vessel. Closing rapidly on his target, Captain Helmut Rathke orders the *U-352* to attack. The decision proves to be a fatal error. For the hapless, calamity-prone U-boat, it is the final misfortune of a hopelessly jinxed patrol.

Only ten months earlier, the crew of the *U-352* had boarded the star-crossed submarine in Flensburg, Germany — Rathke's hometown. On its first patrol off Iceland in November, the *U-352* bore down on a merchantman but was forced to retreat by four British corvettes.

While returning to base, the sub attacked an Allied destroyer, firing a spread of four torpedoes. All four missed, and the destroyer steamed on, its crew unaware they had been attacked.

The luckless sub then sailed for St. Nazaire, in the mouth of the Loire River, and was refitted with 14 torpedoes.

Sailing under new orders, the *U-352* set course for American waters, where her luck was to sour for good. Over the next few months, the U-boat fired seven torpedoes at American ships. In each instance, the submarine hit nothing. Only two days before her final fight, the sub was attacked by an American aircraft and narrowly avoided being damaged. The pilot was mistakenly credited with a kill.

Finally, on May 9, Rathke ordered his crew to fire two torpedoes at the ship he thought was a merchant vessel. The ship he attacked was, however, the *U.S.S. Icarus*, a Coast Guard cutter. One torpedo passed harmlessly astern of the *Icarus* and the other misfired, exploding some 200 yards from the cutter. Realizing his target was a warship, Rathke directed his navigator to steer into the turbulence created by the exploded torpedo in an effort to mask the sub's location.

The commander of the *Icarus*, Lieutenant Maurice Jester, chose the same spot to begin a counterattack with depth charges. The first five charges exploded around the conning tower, demolishing the sub's periscope and killing Lieutenant Joseph Ernst. Subsequent charges killed the engineering officer and ripped the sub's 88 mm deck gun from its mount. The *U-352*, crippled and without power, could neither run nor fight. All hope of escape was gone.

Captain Rathke ordered the stricken sub up, but only the conning tower hatch managed to clear the surface. Closing from 800 yards, the *Icarus* opened fire with its main three inch cannon and machine guns while German sailors scrambled into the seas. Others stayed behind to set and detonate charges to scuttle the sub.

As the U-boat sank, the *Icarus* steamed away to investigate another sonar contact, returning 40 minutes later to pick up the 33 crew members who survived the attack. One wounded sailor later died onboard the *Icarus* and was buried in Charleston, South Carolina.

While other U-boats were unceremoniously sinking Allied shipping, the war record of the *U-352* tells a story of hapless service by a sub that never hit an enemy vessel in 13 tries. When the jinxed U-boat plunged beneath the waves for the last time, she took 13 crew men with her.

For more than 30 years, the *U-352* lay silent and forgotten in her watery grave, disturbed only by passing schools of fish and an occasional shark. With the passage of time, the submarine's outer shell deteriorated, leaving only the pressure hull and structural framing intact. The wreck eventually became home for a variety of marine animals, and it was quickly covered by marine growth.

But this tranquil scene changed dramatically in 1975, when a charter boat captain correctly guessed at the identity of a low profile on his sonar screen. The *U-352* had been rediscovered, in 110 feet of water, 26 miles off Morehead City, North Carolina. It wasn't long before the sub once again came under attack.

Instead of depth charges, the sub was assailed by legions of salvagers and souvenir-seeking sport divers; an alarmed U.S. Senator; and by U.S. Navy officials who, caught squarely in the middle, probably wish they'd never heard of the *U-352*.

The sub quickly became a magnet for divers, and a "cottage industry" sprang up along the coast chartering tours to explore the graves of Nazi U-boats. Some divers paid as much as $200 to be led into the *U-352's* murky chambers.

In July 1978, U.S. Senator Lowell P. Weicker, Jr. (R. Conn.), personally dove on the wreck after North Carolina salvage divers told members of his staff the *U-352* was waiting to blow sky high.

What Weicker saw on the bottom was enough to convince him the remaining ordnance onboard the *U-352* was indeed dangerous. A flurry of correspondence ensued between Weicker and Department of Defense officials, with Weicker demanding the Navy take action to render the sub safe.

Two days after his initial dive, Weicker wrote then Secretary of Defense Harold Brown voicing his concern over several torpedoes and other ordnance onboard which he said presented an "imminent danger" to divers and fishermen alike. "There is no time for buckpassing when lives are at stake," Weicker wrote.

The resulting controversy over what to do with the hulk angered divers, who feared the Navy might blow up the sub. It also raised questions of international law and touched a painful nerve of the West German government, which still considers the *U-352* a "war memorial" and final resting place for members of her crew, as does the U.S. government.

Public concern in the U.S. and in West Germany turned to public outrage when it was learned the search for souvenirs by sport divers had extended to bones of the submarine's crew. Weicker branded the pilfering a "national disgrace."

Much of the anger was directed at a Jacksonville dive shop, which displayed the bones of *U-352* crewmembers for two years and used them to help advertise the firm's chartered trips to the sub. The bones, which are said to be parts of three bodies, included several skulls, finger bones, collar bones, leg bones and a pelvis.

The bones disappeared when the shop closed in the summer of 1977. By then, local divers had already earned a reputation as "ghoul divers" after a 1976 magazine article described in detail how divers had smuggled the remains of dead sailors through a hatch in the submarine's conning tower.

One of the first divers to discover human remains on the sub related how he stashed a skull fragment in his wetsuit on the way to the surface, "in case the captain (of the dive boat) was superstitious." A diver on another expedition recalled watching, "one by one the tiny, delicate bones of a man's hand . . . fall out with the silt," while a diver worked to loosen a signal light.

In September 1979, another round of controversy was touched off by the widely-publicized recovery of one of the *U-352's* propellers by Virginia sport diver Dave Bluett, a member of the Washington, D.C. based Capitol Divers Association. Diving on weekends and holidays, Bluett struggled for more than a year against adverse conditions, competition from other divers, and the threatened destruction of the sub before he was able to raise the propeller. A fellow diver commented: "You might say the propeller was Dave's Moby Dick."

John Wenzel, then secretary of NAUI, reacted angrily to the removal of the propeller. His comments in a letter to the Washington Post were typical of the criticism leveled at Bluett.

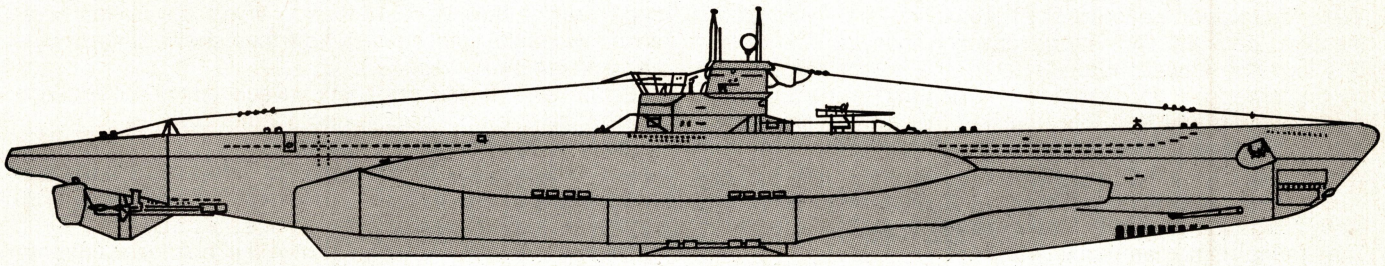
"All divers share their joy in the successful salvage of a magnificent artifact," Wenzel wrote. "But more important, we regret this despoilation of a new defenseless war memorial of singularly poetic majesty.

"The excuse offered for recovery of the propeller is that now others will be able to see it. This apology lacks logic. It is akin to saying we ought to remove beautiful stalactites from caves so that one will not have to crawl underground to see them.

"In short, what happens to the grandeur of the entire scene? How soon will this wreck no longer offer the pleasure of its setting and still somewhat intact glory?

"Elsewhere, the lesson has been learned. For example, in the Truk Islands it is forbidden by law to remove anything from an entire Japanese fleet now laying anchor in a watery grave.

"The defacing of Captain Helmut Rathke's former command is deeply regretted. We are all saddened and a bit poorer because of the actions of these perhaps well-intentioned but unwitting few."



The Nazi submarine, *U-352*, was sunk off North Carolina in 1942. The hapless sub never hit an enemy vessel in 13 tries. The sunken craft is now a popular destination for divers and the presence of live ordnance and human remains aboard her has created controversy.

Bluett, who has placed the propeller on public display and may eventually donate it to a museum, is quick to defend his actions.

"A shipwreck in the ocean is subject to encrustations, drifting sands and such to the point where the wreck can no longer be recognizable," Bluett asserts. "And they're subject to commercial salvagers who often simply use explosives and tear everything up. There is something to be said, I think, for bringing things up before the ocean swallows them forever.

"The critics have a point about the propeller being large enough to be recognizable, but I sampled my opinion base among all the senior divers I know and they all said 'go to it.' And I knew some professional divers were going to go after it, so it was only a matter of time.

"I have strong feelings about this wreck. Ever since Weicker blew the whistle on the ordnance, the wreck has been and still is under threat of destruction.

"This government meddling caused me to push myself more than I normally would have. We went out with the knowledge that each dive could be our last, because we never knew when or if the Navy might blow up the sub . . . and turn it into just so many ashtrays."

While Bluett worried about the sub's survival, Weicker worried about the welfare of divers like Bluett, who labored on the propeller only three feet from a torpedo jutting out of a stern firing tube. In October 1979, Weicker wrote Harold Brown again complaining that little had been done about the sub since his first letter 15 months previously.

"I realize the Navy has not been totally inactive," Weicker wrote. "An on-site investigation was conducted by an EOD (Explosive Ordnance Disposal) team which concluded that the

U-352 presents a substantial danger to marine activity within the immediate vicinity. Last December, the Federal Republic of Germany agreed that the U.S. Navy take appropriate measures for recovery or demolition of the wreck . . . to render harmless the hazards posed by the *U-352*. In a letter of January 16, 1979, the Department of the Navy assured me that these operations would take place, once climactic conditions permit. In spite of all these suggestions for prompt action, I have seen nothing but footdragging by the Navy.

"It is clear to me that the Navy has chosen the path of least resistance. Divers are outraged that the government may interfere with a unique wreck site. Coastal communities in the vicinity are concerned that their local economies may be jeopardized. Environmentalists fear any intervention into a pristine area beneath the sea. The decision is not an easy one. I sincerely hope that the Navy does not wait for a death to occur before appropriate action is taken."

But the Navy did not act until May 29, 1980. From that date until July 6, the *U.S.S. Hoist*, with three teams of divers aboard, conducted survey and limited ordnance disposal operations. In all, the Navy divers made 137 dives on the sub and accumulated more than 361 hours of bottom time.

They identified and removed numerous rounds from the sub's deck gun (long ago recovered by salvagers) and an unexploded torpedo warhead which was discovered wedged in the sub's deck framing. After excavating mud, sand and debris from the forward torpedo room, the divers discovered seven torpedoes, including two torpedoes inside torpedo tubes number one and four. Outside the sub, divers found a torpedo wedged under the sub's starboard side, with the warhead section extending about five feet under the *U-352*.

The divers also X-rayed the torpedo protruding from the stern firing tube and found the exploder was not yet armed. They found no human remains.

Early indications of the Navy's final plan for the sub were revealed when the Chief of Naval Operations issued a finding of no significant environmental impact.

"The torpedoes in the forward room," according to the document, "do not pose a hazard as long as left undisturbed, i.e., if restricted from access they will not explode spontaneously, but the torpedo in the aft tube does constitute a hazard as it can be approached from outside the hull. Accordingly, the preferred alternative is to perform an underwater burn to render the ordnance safe."

The underwater burn referred to involves the use of a classified device called ITROD, or Incendiary Torch Remote Opening Device. Relatively untried, the device was used successfully on the torpedo warhead located on the *U-352*'s deck. An idea of how the device works can be gleaned from the following description in an unclassified report on the operations.

"Divers . . . placed the torpedo warhead section into a cargo net lowered to the bottom by a two inch nylon line. Utilizing the winch of the ship's port workboat, the torpedo was lifted approximately three feet off the ocean floor and towed to a point 1500 yards away from the ship and submarine. Utilizing scuba, EOD personnel successfully performed the ITROD burn of the warhead explosive filler . . . The first sign of the warhead burning was a large amount of smoke and bubbles on the surface. Approximately five minutes after commencing the burn, the warhead became buoyant and ascended to the surface engulfed in flames. The warhead was recovered and lifted onboard along with five pounds of raw explosive and seven pounds of residual."

The finding of no significant impact went on to admit that the same technique, if performed on the stern torpedo, "could, but is not expected to, cause severe damage to the aft section of the submarine were the explosives to detonate."

But the earlier report on the dive operations had ruled out the use of the ITROD procedure altogether: "An EOD diver confirmed that the stern torpedo could not be burned in place using the ITROD. The position of the torpedo in the stern tube will not allow burning, as the ITROD cannot be properly attached . . ."

A Navy spokesman had previously said touching the torpedo was a "high risk" proposition, and he said all the torpedoes could be more dangerous now than when they were new.

"It is possible that safety devices could have become eroded, making the ordnance more sensitive," the spokesman said. Nonetheless, Navy divers returned to the sub last June 18 and spent the next nine days attempting to disarm the remaining ordnance outside the sub. After making a total of 67 dives, they succeeded in disarming both the torpedo lodged under the starboard side and the stern torpedo. But the process was not without incident. While the ITROD was employed on the stern torpedo, the exploder attached to the torpedo's nose accidentally detonated. Fortunately, the torpedo's 600 pounds of high explosive did not, and there were no injuries. However, divers later discovered a "hairline" crack in the sub's pressure hull near the torpedo.

The Navy divers also placed steel plates across all five of the open entrances to the submarine to prevent access and, "accidental detonation of any of the torpedos inside the hull or their associated exploders, six of which could not be located and could be anywhere inside the vessel."

The idea had earlier met with stiff opposition from sport divers who warned, "They (the gratings) probably won't stay there long." True to their word, renegade divers have already removed two of the steel covers and a third shows signs of having been tampered with.

"It's a compromise position between doing nothing and blowing the sub up," complained another diver.

Earlier, a spokesman for Capitol Divers, whose members have dived regularly on the sub said, "We would have preferred they left the sub alone." Now, new club president, Maggie Hayes, says, "The least interference they make to the sub that allows divers to enjoy it as as dive site, but doesn't expose them to danger, is most desirable." However, she said Capitol Divers would never have sanctioned diving on the sub unless the club felt it was safe.

But government officials maintain that subs like the *U-352* continue to pose a serious threat to life. They point to an incident off the New Jersey coast in September, 1968, when a fisherman caught a Nazi torpedo in his nets and brought it aboard his boat. Luckily the torpedo was quickly disarmed.

And, according to Rear Admiral Roy F. Hoffmann, such an occurrence has already claimed several lives. Hoffmann, former commander of the Charleston Naval Base, told reporters that a trawler operating out of Norfolk several years ago also snagged a torpedo in its nets. The torpedo, Hoffmann said, exploded, killing several fishermen.

But divers and officials alike are concerned about the *U-352* for another reason: the Navy's action may well have set an unalterable precedent for similar operations in the future. There are literally hundreds of sunken ships off the East Coast, and many contain hazardous ordnance.

According to Navy records, at least six U-boats lie in shallow water off the eastern U.S. seaboard. Sources say all six can be reached using commercially available dive gear. One U-boat lies off Newport, Rhode Island, and another one can be found off Virginia. There is another sub southeast of Nantucket, Massachusetts, two near the North Carolina coast and one more off New Orleans.

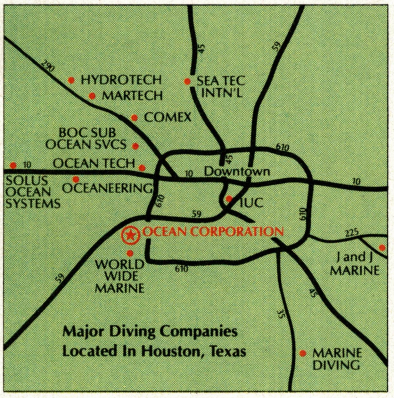
While the growing popularity of the subs with sport divers has made their safety an issue, the concerns of the West German people and their government are quite different. Their attitudes were perhaps best summed up three years ago by Captain Dieter Ehrhardt, then naval liaison for the German Embassy in Washington.

Ehrhardt, who lost two brothers in service on other U-boats during World War II, said, "My government prefers to leave wreckage from World War II at the bottom of the sea, to give the dead sailors rest . . . Generally speaking, the boat is a cemetery, and nobody wants to disturb a cemetery. It is not good, if you are in a cemetery, to pull bodies out of the earth."

Why Houston?

BECAUSE

The Ocean Corporation is located in Houston and more commercial divers are hired in Houston than in any other place in the world. Twelve diving companies are located in Houston including three of the four largest in the U.S. Many others are located in the nearby New Orleans area.The demand for divers is so great in Houston that large locally based diving companies like Ocean Systems, Hydrotech Systems, Martech International and Sea Tech International have hired many of our students for part-time work while they were attending school. Over 90% of our recent graduates went to work for these and other local diving companies when they completed our program. Houston is the place where the action is...the commercial diving, offshore construction and oil industry capital of the world.

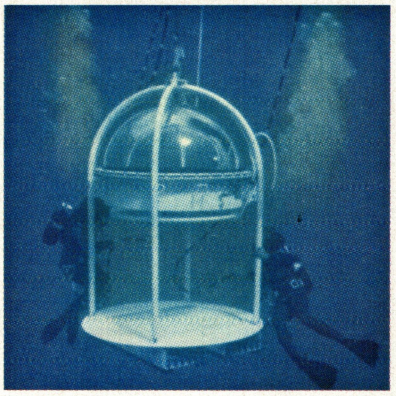


BECAUSE

The Ocean Corporation is a commercial diving company, not just a school. Our facilities, equipment and training aids are the best, and our diving systems are as up-to-date as possible... because much of the equipment is used by our diving operations division to perform actual diving contracts in the field. Ocean Corporation has successfully completed many underwater jobs for various industrial clients over the years... including specialized underwater inspections, maintenance and repair work. For example, we did the world's first commercial underwater repair job in a nuclear power plant. And most of our divers have been graduates of our own school.

BECAUSE

The Ocean Corporation is a convenient and exciting place to go to school. Houston is one of the fastest-growing and most dynamic cities anywhere. It is a city of expansion, energy and youth (the average resident's age is in the mid-20's). Houston offers every conceivable kind of entertainment, from sports events, ultra-modern discos and open-air theater to rough-house local rodeos, chili cook-offs and the new Texas-size country-western dance clubs. Reasonably priced adult and singles apartments are readily available within walking distance of the school, and fast-food to luxury restaurants are nearby. The semi-tropical climate is wonderful, the sport diving is great and the folks are friendly.



BECAUSE

The Ocean Corporation management and instructor staff have long-term experience in the international offshore oilfield diving business. Retired ex-military divers and sport scuba divers don't run the school...*commercial* divers do. For example, the President of The Ocean Corporation, Larry Cushman, was Vice President and Europe/Africa Area Manager for Ocean Systems, Inc. for three years...with responsibility for all North Sea diving and underwater construction operations. He also worked six years as a manager for Oceaneering International, Inc., another of the world's largest commercial diving contractors. Ocean Corporation managers and instructors know today's diving business...first-hand, from recent experience.

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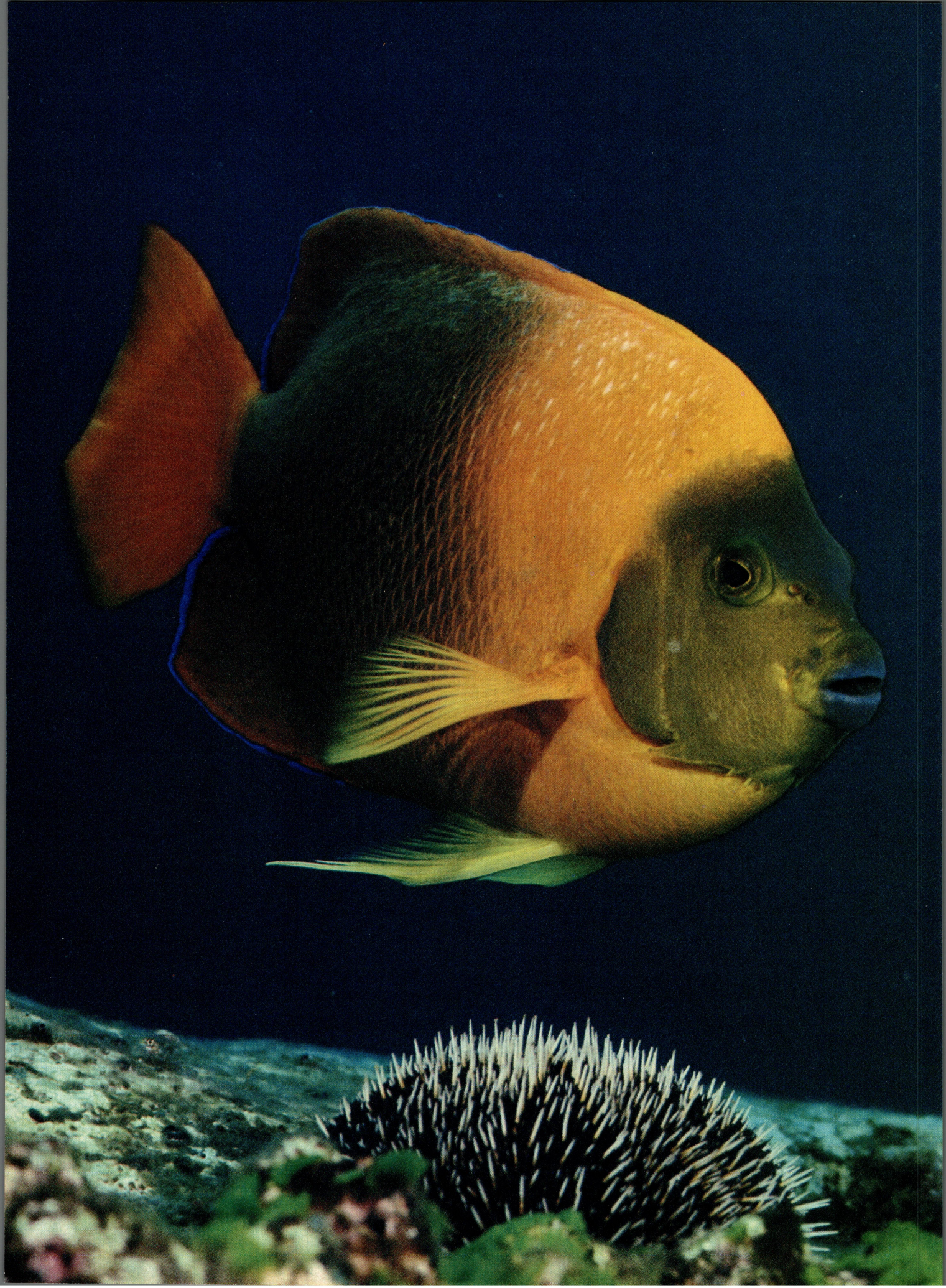


The Clarion Angelfish

(Holacanthus clarionensis)

In the Sea of Cortez (Gulf of California) there are three species of *peces angels* — angelfishes: Cortez angelfish, king angelfish, and Clarion angelfish. As in other oceans of the world, these three Mexican angelfishes are spectacular reef inhabitants, their bright colors accentuating their big, pancake shapes; their swimming style slow, regal and stately. The Clarion angelfish is not as common as the other two species. Scientists D. Thomson, L. Findley and A. Kerstitch report its range from off the Baja mainland, where it is found in the cape area (Cabo San Lucas) and more specifically off Cabo Pulmo. It is most abundant off Clarion Island, a tiny, uninhabited rock that is part of the Revillagigedo archipelago. This remote group of three islets is about 400 miles south of Baja and 420 miles east of mainland Mexico. □ The coloration and markings of the Clarion angelfish are brightly distinctive. The fish is a brilliant orange with a dusky olive face and posterior area. The tail is bright orange and there is an iridescent blue rim on the dorsal and anal fins. As is the case with most angelfish species, the juvenile is quite different from the adult. The young Clarion angelfish is orange with a series of black vertical bars over its body, with two vertical black bars forming a striped effect at the eye. This juvenile looks very similar to the young king angelfish, except the markings of the immature king angelfish are blue instead of black. □ The angelfishes (Pomacanthinae) are classed together with the butterflyfishes (Chaetodontinae) in the same family, Chaetodontidae. However, some ichthyologists prefer to consider them as separate families, Pomacanthidae for angelfishes, Chaetodontidae for the butterflyfishes. Chaetodont means bristle tooth, and since this characteristic is found in both angelfishes and butterflyfishes, the two have long been classed together. The minute brush-like teeth are well suited for filtering out the small organisms that both fishes feed on. The angelfish's diet consists mainly of sponges. They also eat algae, tunicates and zoantharians (anemones, corals). Juvenile angelfishes have been observed picking ectoparasites from other fishes, and these are an important part of their diets. Angelfishes are diurnal, spreading out to feed on the reefs by day and entering a sleepy state, or torpor, by night. □ The biggest differences between angelfishes and butterflyfishes are visible. Butterflyfishes have more pointed snouts and spiky heads, and are generally smaller. The average size for a butterflyfish ranges between 6 to 8 inches; angelfishes are 12-14 inches in length. In the angelfish there is a strong preopercular spine, the butterflyfish has none. This spine, an important taxonomic characteristic, is very obvious just below the cheek. In the Clarion angelfish, this can be seen at the lower edge of its dark face. □ There are also differences between the two fishes in behavior. Like their dry-land namesakes, butterflyfishes flit about the reefs like butterflies, often in pairs, while angelfishes seem to take more time and generally are alone. Angelfishes are wary and divers will have a harder time getting close to them. However, if an angelfish can be enticed to eat out of the diver's hand it will become quite fearless, confident and trusting, following the diver about the reef.

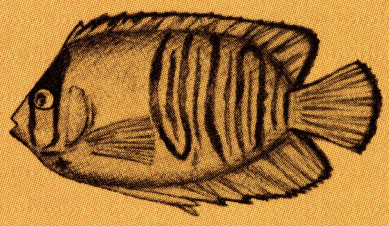
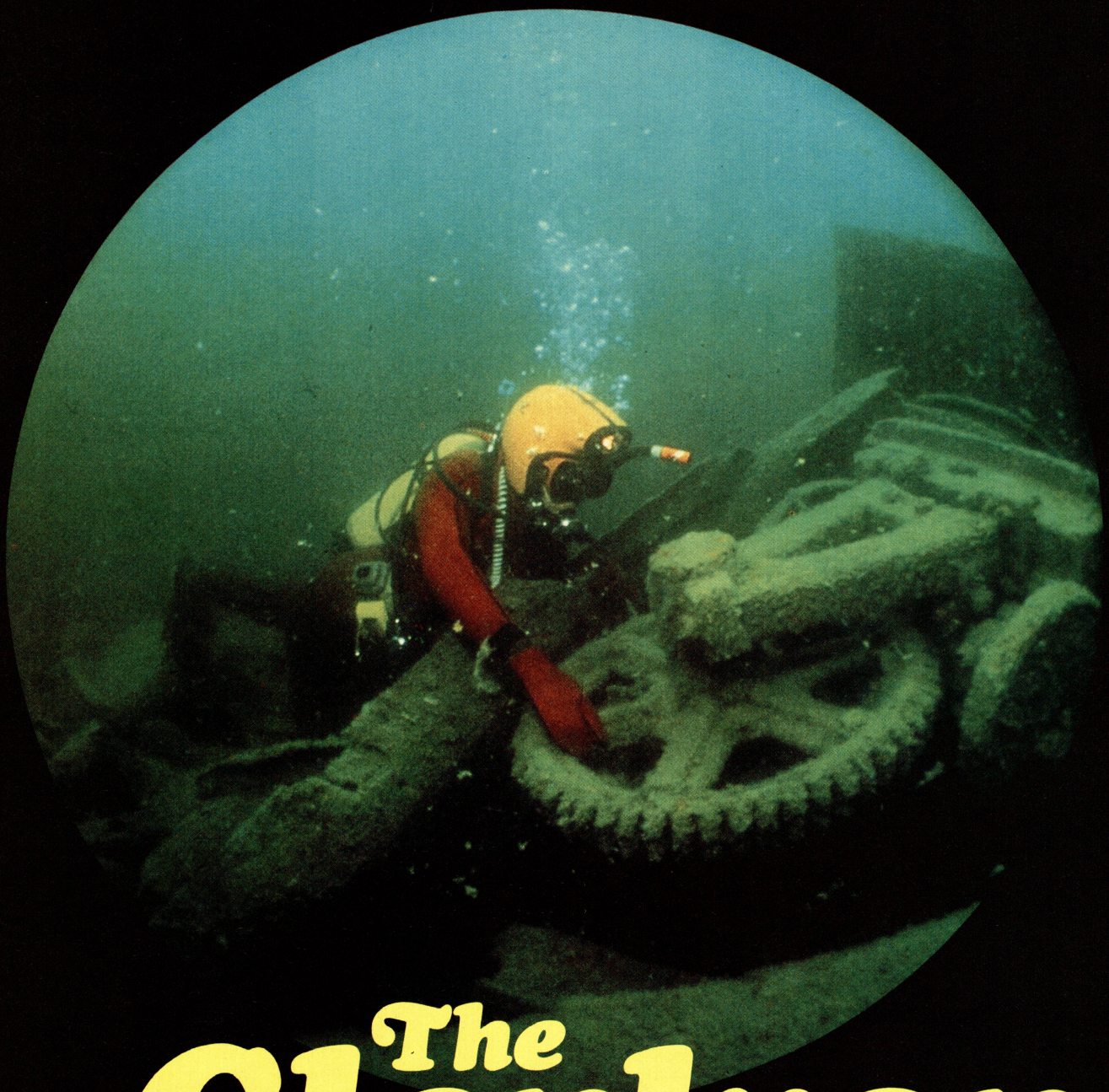


Photo By Howard Hall - Text By Hillary Hauser

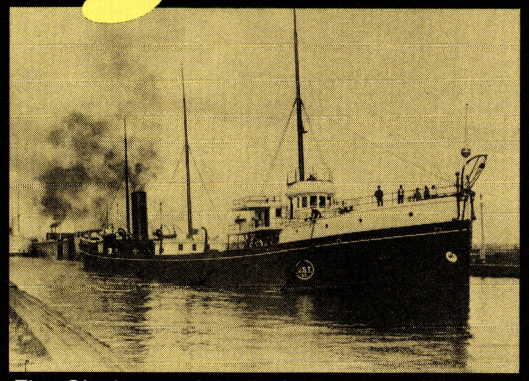
Hall took the photo in 40 feet of water off the Socorro Islands. He used a Nikon F with a 55 mm macro lens in a Farallon/Oceanic Hydro 35, two SR2000 strobes. Kodachrome 64 shot at f8, 1/60 sec., 18 inches from subject.



The Glenlyon

Isle Royale Becomes Great Lakes Mecca For Wreck Divers

By Frederick Stonehouse



The *Glenlyon*, originally built as the *William H. Gratwick* in 1893, was 328 feet in length, 42 feet in beam and weighed 2818 gross tons.

Many divers in the Midwest are familiar with the many fantastic shipwrecks of Isle Royale National Park in Lake Superior. The wrecks, ranging from modern steel ore carriers to a 19th century sidewheeler, are the most outstanding in the Great Lakes. To the freshwater diver seeking intact wrecks, Isle Royale represents the Mount Olympus of diving. There just isn't any better location.

For those who are not familiar with this area, a note of explanation is in order. Isle Royale is a rocky island approximately 45 miles long and 9 miles wide, located 50 miles north of Michigan's rugged Keweenaw Peninsula and 20 miles south of the Canadian border. This wilderness island is surrounded by over 200 smaller islands. Long considered one of Lake Superior's most remote and beautiful locations, it is also home for approximately 675 moose and 50 timber wolves.

The island's collection of ten major wrecks is the result of the traditional factors of foul weather, fog and faulty navigation. Coupled with its proximity to the shipping lanes (to and from Canada's Thunder Bay) and the shallow rock reefs, these are deadly combinations.

The island's environment is hostile at best. Severe weather closes the park completely from December through April. During this period the island is literally sheathed in ice and snow and temperatures plummet as far as -30° F. Large ice floes usually remain until late April. During the spring and fall dense fog is commonplace and lake storms often generate 20 to 30 foot waves.

Although the past several centuries saw various activities on the island, including historic copper mining, logging and commercial fishing, since 1940 the island has been a National Park. Today an estimated 15,000 people visit the island each year, mostly to hike and camp in the wilderness and enjoy the unbelievable natural beauty of a land nearly forgotten by time.

Increasingly, however, a new breed of visitor is using the island, the scuba diver. In 1970, divers on the island were extremely rare. In 1979, Isle Royale National Park Service figures showed 564 divers made 2153 dives on the wrecks. The pressure is expected to increase annually as more and more divers discover this area.

The island's shipwrecks are an impressive attraction for the diver. To protect them, the Isle Royale National Park Service has instituted a policy of strict conservation. Part of the policy includes the registration of all divers as they arrive on the island and the active presence of park rangers on boat patrol. The wrecks may be explored, experienced and photographed, but not salvaged. All artifacts are to be left for other divers to enjoy.

One of the less frequently explored wrecks of Isle Royale is the 328 foot, 2818 ton Canadian steamer *Glenlyon*. Owned by the Great Lakes Transportation Company, the steamer was built at West Bay City, Michigan in 1893.

As part of its ongoing shipwreck research program, Northern Michigan University (Marquette, Michigan) has conducted a shipwreck survey at Isle Royale for two years and is currently surveying the *Glenlyon* and other Lake Superior shipwrecks.

The special survey has provided information on the size, location, composition and depth of the wreckage, as well as an estimate of the resource potential.

The day of reckoning for the *Glenlyon* came on October 30, 1924. She was outbound from Thunder Bay, Canada, enroute to Port Colborne with a full cargo of 145,000 bushels of wheat when overtaken by a howling northwest gale. Deciding to seek shelter in the wide expanse of Isle Royale's Siskiwit Bay, her captain reversed course and alerted the pilothouse watch to keep a sharp eye peeled for Menagerie Island Light. The lighthouse would mark the northern tip of a string of small islands and reefs that guard the eastern approaches to Siskiwit Bay. The captain intended to swing north of the lighthouse and safely into the bay, but the blowing scud and gloom of the gale blinded the steamers' lookouts and she plowed dead onto a rock reef. When the gale lulled, the startled crew saw Menagerie Island Light a bare quarter mile away to port and the mainland of Isle Royale eight miles to the west. Had the steamer been 25 yards further north, she would have been safe!

Although the captain tried to hold his crew aboard until a proper rescue could be organized, his mate and another member of the crew hastily abandoned the steamer in a small yawl, intending to row to the mainland of Isle Royale. The two panicked sailors badly misjudged the power of the gale. Caught in the maw of the northwest seas they were blown 65 miles south where they finally washed ashore on Apostle Island — two days later! The remainder of the crew was rescued a day after the wreck.

The *Glenlyon* remained straddled on the reef, bow on one side and stern on the other. Since it was too late in the season for any hope of immediate salvage, the vessel owners left her, intending to return in the spring and haul her free. When spring came and the salvors returned they were shocked. The raging storms and crushing ice pack of a Lake Superior winter had totally destroyed the steamer. There was nothing left to salvage.

The 56 years since the loss have not been kind to the *Glenlyon*. Fierce storms and 20 foot thick ice floes have almost flattened her. But, surprisingly, much still remains. Although she is largely flattened, the bow is partially intact and like the majority of the wreckage, rests in a bare 30 feet or so of frigid Lake Superior water. A large winch is still present and the anchor chain is yet in the chain lockers. Surprisingly, two Navy-style anchors continue to dangle from the bow pockets. Normally the anchors and chain would have been prime targets for salvage.

Further aft, the old mate's cabin remains generally intact and penetration is possible. The wooden tongue-in-groove or wainscoating paneling on the bulkhead walls is still complete, mute testimony to the preservative powers of 36°F waters.

The mid-ships portion of the wreck, once lying over the spine of the rock reef, is now missing, the result of the intense gales that frequently sweep over the exposed wreck site. Off to each side of the reef, among the irregularities of the sandstone bottom, are large sections of steel hull and deck plates; each piece is twisted as if it were cardboard!

The stern section of the wreck is dominated by the massive 1200 horsepower steam engine. Knocked over on its port side, the engine provides a unique opportunity to closely examine an intact example of turn-of-the-century marine engine technology. The engine stands alone. The original cabin and hull structure has been peeled away like the skin of a banana.

From the engine a diver can follow the drive shaft through the reduction gearing to the pillow block coupling and eventually to the propeller which rests firmly on the bottom. Although two blades of the original four blades have been sheared off, evidently as the result of the wreck, two unused blades are on the bottom a mere five yards away. Strangely, they were never recovered by the professional salvors arriving immediately after the wreck.

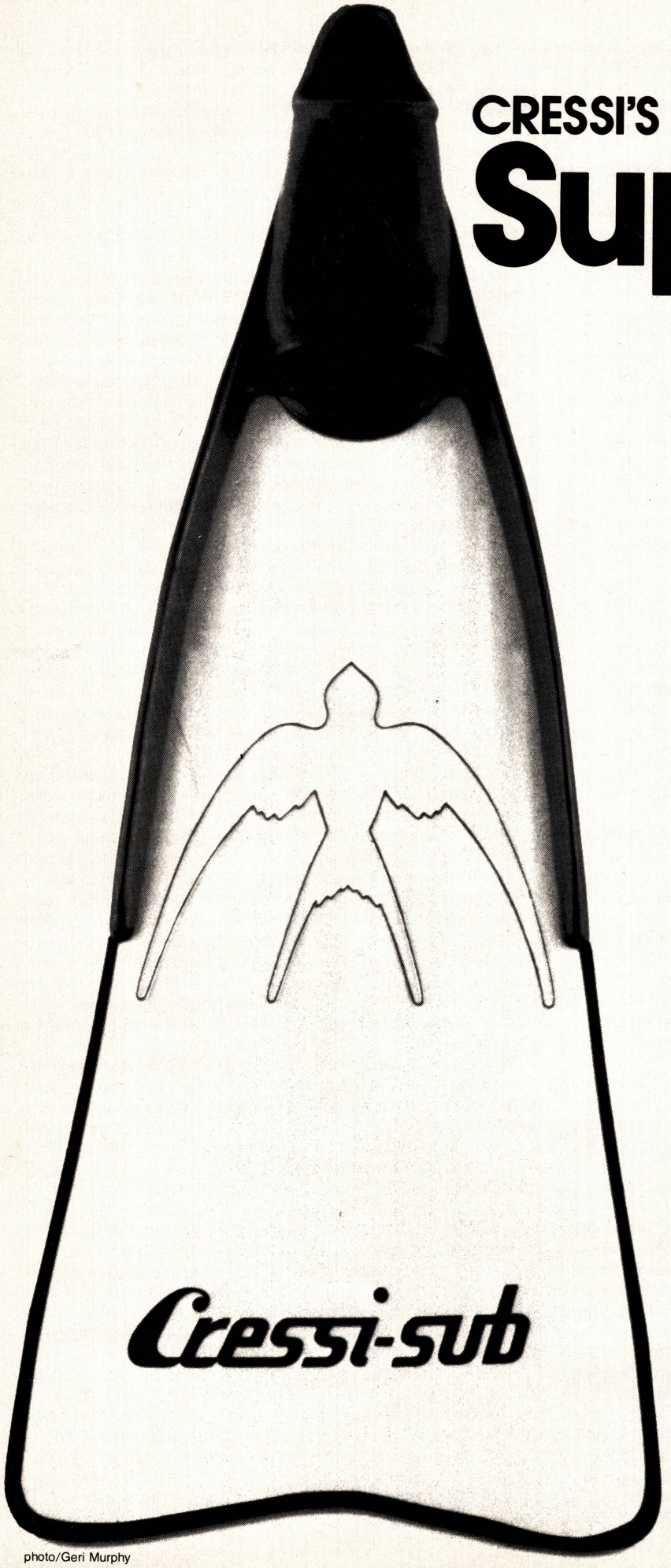
Photographic conditions on the *Glenlyon* are usually excellent, 50 foot visibility is common and the relatively shallow water allows a large amount of surface light to penetrate. Increasingly, underwater photography is becoming an activity outlet for the Great Lakes diver and the *Glenlyon* offers countless possibilities for practice.

Exploring the *Glenlyon* with a sharp eye will reveal much of memorabila typically lost from wrecks: portholes, door handles, engine room gauges, electrical fittings and brass items of every description. It is the presence of these artifacts that makes the ship so fascinating. Not because they have any intrinsic historic value, but because they allow a diver to experience a wreck that is largely complete in this minutia.

The reason the wreck is generally unexplored is basically owing to her location. On an exposed reef, she is open to the full force of heavy weather from nearly every direction, thus, simply anchoring on her can be difficult. The wreck is also far from the normal dive areas, making a special trip necessary. Lastly, she isn't one of the glamour wrecks of the island.

With her wealth of dive experiences, opportunities for exploration and photography, the *Glenlyon* will increasingly become a major asset in the Isle Royale National Park shipwreck collection.

photo/courtesy Dossin Great Lakes Institute
color photo/Bob Sheridan



photo/Geri Murphy

CRESSI'S Superfin

The new Rondine Gara is long and snappy

By Eric Hanauer

At first glance, it looks more like a water ski than a swim fin. I mean, it's *long*. Half-again as long as a normal fin. Nearly as long as a diver's leg. But with these things on your feet, you feel like Mark Spitz going through the water.

With their long, slim nylon blades, Cressi's new Rondine Gara fins look as sleek as a new Ferrari. The price, when compared to ordinary fins, is also in the Ferrari class. The analogy can be carried a step further. Like its compatriot sports car, the Gara fin is designed for a special purpose. It's not an all-around fin for all dive conditions, but it performs its specialized tasks extremely well.

Long fins aren't really all that new. The first, Nemrod's Commando, came out in 1963. It was a copy of the popular American Duck Feet, but nearly twice as long. The fin didn't really catch on and was discontinued due to production problems.

The next long fins showed up about ten years ago in German swimming pool competitions. It's a bit cold for comfortable diving during German winters, so the divers of that country began a series of underwater races in 50 meter pools, both with and without scuba. They soon discovered that longer fins provide more thrust and more speed with less effort. It wasn't long before Cressi, Mares and other European manufacturers brought out the long, flexible fins favored by the underwater speed swimmers.

They were soon adopted by skin divers, who found their easy propulsion gave them an advantage in spearfishing competitions. Jacques Mayol of France used a special version of the Cressi Rondine L fin on his record 328 foot breath-hold dive in 1976. The Rondine L, the Italian firm's first entry in the speed fin market, has a rubber blade with external ribs running its length. In production since 1976, it has caught on in the warm water

areas of America, especially among instructors and dive boat skippers.

Mayol collaborated with Cressi's engineers on the design of a plastic blade to give the fin more flexibility and whip. The result is the new Rondine Gara, featuring a choice of two nylon blades attached to a rubber fin with a full foot pocket. The reinforcing rubber ribs end nine and one-half inches from the end of the blade to allow for flexibility. The yellow blade has the greatest degree of flex and is designed for the diver with an average kick. The black blade is stiffer and requires a bit more effort, resulting in more power and speed. Both nylon blades have more flex and whip than the Rondine L, but the manufacturer rates the black Gara first in terms of power, the L second, and the yellow Gara third.

The author tested all three models, first in a swimming pool, then on beach dives and finally on a weekend of boat diving at Catalina Island. He was assisted by Mia Tegner, Mike Curtis and Sam Miller.

The first general impression of Cressi fins is that they feel as though you aren't wearing fins at all. This effect is most pronounced with the nylon blades. The rubber fins seem to cause a bit more drag on the downbeat. The kick used with all models is almost like a normal swimming flutter kick, with more knee bend than that used with conventional fins. All test divers spoke of power and speed with less effort. The effect was most apparent while skin diving, as each kick seemed to propel the diver further than shorter fins. On scuba, the effect is most pronounced when kicking hard for extra speed, although even normal kicking seemed just a bit easier.

photo/Eric Hanauer

The Cressi-sub Rondine fins are 32 inches long. This radical departure in design from ordinary dive fins results in increased power and speed with less kicking effort.

Sometimes it seems so easy it fools you. On the third day of the test I was cruising at 100 feet and didn't feel I was making progress in relation to the effort expended. Then I noticed the kelp leaning in the current and looked back at my buddy, who was unable to keep up. One normally doesn't expect a strong current at that depth, and with the Gara fin I was barely aware of it.

Observation of other divers' kicks demonstrated the extreme flexibility of both versions of the nylon blade. When the leg is extended at the end of the kick, the blade is bent back at an extreme angle. It continues to whip backward and down even while the leg is beginning its recovery. This probably accounts for the feeling of extra power in a flutter or dolphin kick. The fin also receives high marks while kicking on the surface, using a trudgen or backstroke kick. Both ways, the diver moves faster, with less effort than with ordinary fins. However, when surface flutter kicking in the face down position, the kick must be shortened to avoid excessive splash.

The fins scored a bit lower on maneuverability, as the extra length made quick changes of direction underwater a bit awkward. Sculling and treading movements, utilizing the bottom of the fin, were less efficient owing to the extreme flexibility. Additionally, sculling movements caused some strain on the inside of the knee joint.

Long fins are not recommended for surf entries. They are awkward when walking through shallow water and a medium sized wave can dump the unwary diver. In a protected cove, I was able to walk barefoot to waist deep water, then inflate my BC and don the fins. However, that won't work in any kind of surf.

As is the case with all full foot fins, Cressis are best in warm water, worn on bare feet. They do not lend themselves well to neoprene booties, which increase your foot measurements by about two sizes.

The design of long racing fins is a radical departure from today's models, which utilize wide, stiff blades for power. The skin diver working from a boat in warm waters will appreciate them the most, but they add a dimension of speed with less effort on scuba as well. The price of progress doesn't come cheap, however. The Rondine L costs from $50 to $61, depending on the size. The Gara retails for $90 in both its configurations. They're not for everyone. But then, neither is a Ferrari.

Diving For Science

Sport Divers Serve As The U/W Eyes For The Scientific Community *By Bill Barada*

"Picture a girl sitting among the rubble and ruin of a once beautiful beach. She measures the blood pressure and pulse rate of four divers prior to their preparations to enter the water. The area they will dive mirrors the ruin of the beach, for in these waters there once resided the largest kelp forest in the world. Now that forest is gone, along with the myriad of life it once harbored. Four other divers are leaving the water and soon she will be measuring their blood pressure and pulse rate. The time is 2:45 am and except for two hours sleep, this girl has been working all night and all the previous day. She is a nurse by profession and a diver by avocation. This time she is not being paid for her nursing efforts. This time her efforts are classified as recreation. She must be crazy.

"The four divers who left the water are being helped by a beach crew to remove their gear.

"'I found number eight,' one of the divers says excitedly. 'The critter had crawled under a rock,' he adds. Then pointing to a mark on his underwater slate, the diver says, 'Right here,' while one of the beach crew shines a flashlight on the slate to observe the location of the 'critter.' The man with the flashlight is in charge of coordinating data. Professionally, he is studying computer programming; he is a diver by avocation.

"'Are all the tags secure?' asks the data coordinator.

"'Secure? Hell, those sea urchins like their tags so much they're hugging them,' exclaims another one of the divers. The group laughs.

"These divers are members of the Ocean Projects Section of the Greater Los Angeles Council of Divers (GLACD) who have just completed their observations of tagged sea urchins during a 24 hour research project. At 1:30 am they had been awakened from their tents so they would be ready to enter the cold Pacific waters at 2:00 am. Like the nurse, these divers are not being paid for their research efforts. Their efforts are recreational. They also must be crazy.

"On the beach, other recreationists go about preparing food, checking tank pressures, and maintaining the logistics of running a safe 24 hour research project — the logistics of putting a team of four divers in the water every hour on the hour over a 24 hour period for the purpose of collecting data. When the project is completed, the over 100 individuals who made the project a success prove they too are crazy by sharing the opinion, 'That was fun. When will we do it again?'"

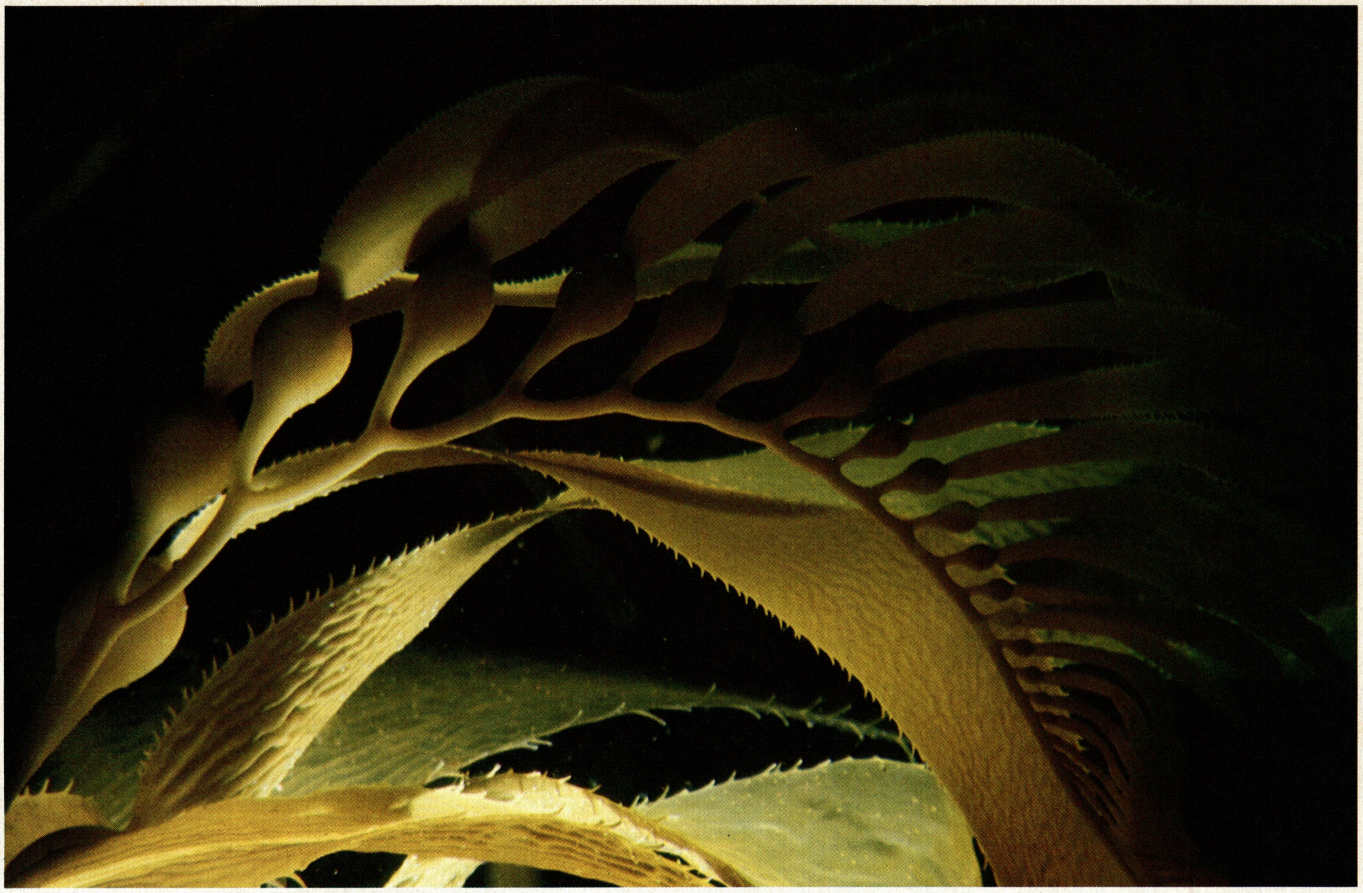
This is the way Coastal Monitoring is described by Paul T. Meister, administrative director of the GLACD Ocean Projects Section. He is discussing a special, high intensity effort, however. Sea urchins feed on kelp and scientists suspect them of destroying Southern California kelp beds. So, GLACD divers decided to tag some sea urchins and follow their movements over a 24 hour period. Thus, the divers could learn things about these creatures that marine scientists could not learn in the laboratory.

This is the essence of coastal monitoring. It involves the careful observation of the marine environment and its inhabitants in the same area over a long period of time. In most cases the research effort is very similar to other kinds of recreational diving in that the monitoring is conducted at a location in which the divers are interested; dives are usually on weekends or holidays, perhaps once each month; very little, if any, special equipment is required; and research diving can be fun. The big difference, and it is big, between underwater research and haphazard diving is that those engaged in Coastal Monitoring carefully record and document their observations. The result, according to Meister, is that "We learn to really see, instead of just looking; and a whole new world is opened that we had been missing before."

The GLACD became involved in underwater research in 1971 as volunteers during a kelp restoration project at White Point in Palos Verdes. The project was administered by the Los Angeles County Department of Parks and Recreation. Money to support the kelp project ran out in 1973, and the Council's Ocean Projects Section was formed to continue the research. I first learned about the program in January, 1980 when Meister sent me their 1979 Project Yearbook. Inside was a note from Meister asking, "Do you think similar programs can be set up in other Councils? It might help establish the recreational diver as a pioneer in protecting the marine environment."

After discussing the program with Meister during my visit to California, I believe the answer to his question will be an emphatic yes; not just because helping to protect and preserve the marine environment is a cause in which sport divers have a vital interest — but because involvement in such a research program will greatly increase our knowledge and understanding of the submarine world and add immeasurably to our dive pleasure.

The GLACD's Ocean Projects Section has already developed a lot of these kinds of data for their area of study at White Point. They know that there is little diversity of marine life; that sea urchins are the dominant organisms; and that the few species of fish in the area are all juveniles. They also know how many abalone exist and that these are virtually all undersized blacks three or four inches in diameter. They have documented the reproduction cycle of certain kelp, and recorded mortality rates and primary predators of abalone returned to the area by Fish and Game. They developed a simple, effective method of tagging sea urchins without damaging or disturbing the creatures and this method was adopted as a thesis by a marine science student. They observed and recorded the spawning habits of a garibaldi as it tended and nourished an underwater garden of red



photo/Geri Murphy

photo/Paul Meister

Above, new blades forming at the terminal tip of a kelp plant (*Macrocystis*). Left, a sculpin at White Point sports a "fur coat" composed of filaments of microscopic organisms. These apparently harmless organisms obtain their nutrients from dissolved minerals issuing from hydrothermal vents. These vents are similar to those found in the deep ocean.

algae during its reproductive cycle. They noted the fish's aggressive behavior in protecting its territory, its subsequent abandonment of the garden after spawning was completed, as well as a repeat of this behavior the following year.

Meister cautions, however, that divers should not utilize their research data to draw conclusions as to the cause of certain phenomenon because, as he points out, this could discredit the data as biased. The purpose is simply to observe and record facts and to document any changes that take place with evidence that cannot be refuted. The official position of the GLACD Ocean Projects Section is to remain aloof from controversy as to cause and effect and let the data speak for itself.

Thus, Coastal Monitoring should be a natural for recreational divers because it is a form of underwater pioneering for which our sport is famous; and it offers another enjoyable way to increase our knowledge of the submarine world. But the most important reason is that, if the program is adopted by dive organizations across the nation, the results of our combined efforts will produce badly needed information about the marine environment that does not now exist — and this type of research could develop into recreational diving's most significant contribution to future generations.

Interested divers can obtain more information by contacting: GLACD, Ocean Projects Section, P.O. Box 1533, Beverly Hills, CA 90210.

The crying need for such information is evident from the fact that, despite our society's advanced technology and sophisticated electronics, we still know more about the moon than we do about the world beneath the sea. It is ironic that Congress was willing to spend more money studying the Sea of Tranquility on the lifeless planet of the moon than they were willing to spend studying the ocean during the same period. And life on earth is dependent upon maintaining a healthy ocean.

The oceans provide provide about 70 percent of the earth's oxygen, supply virtually all of our fresh water, and modulate our weather and climate. The sea's wondrous variety of plants and animals are the primary source of food for about two-thirds of the earth's people. Marine life contains gene pools with a potential of enormous importance in medicine, agriculture and other areas. The oceans are also a place for sport and learning that are of indescribable psychological value to humans — an escape hatch that gives refuge from the stress of modern civilization.

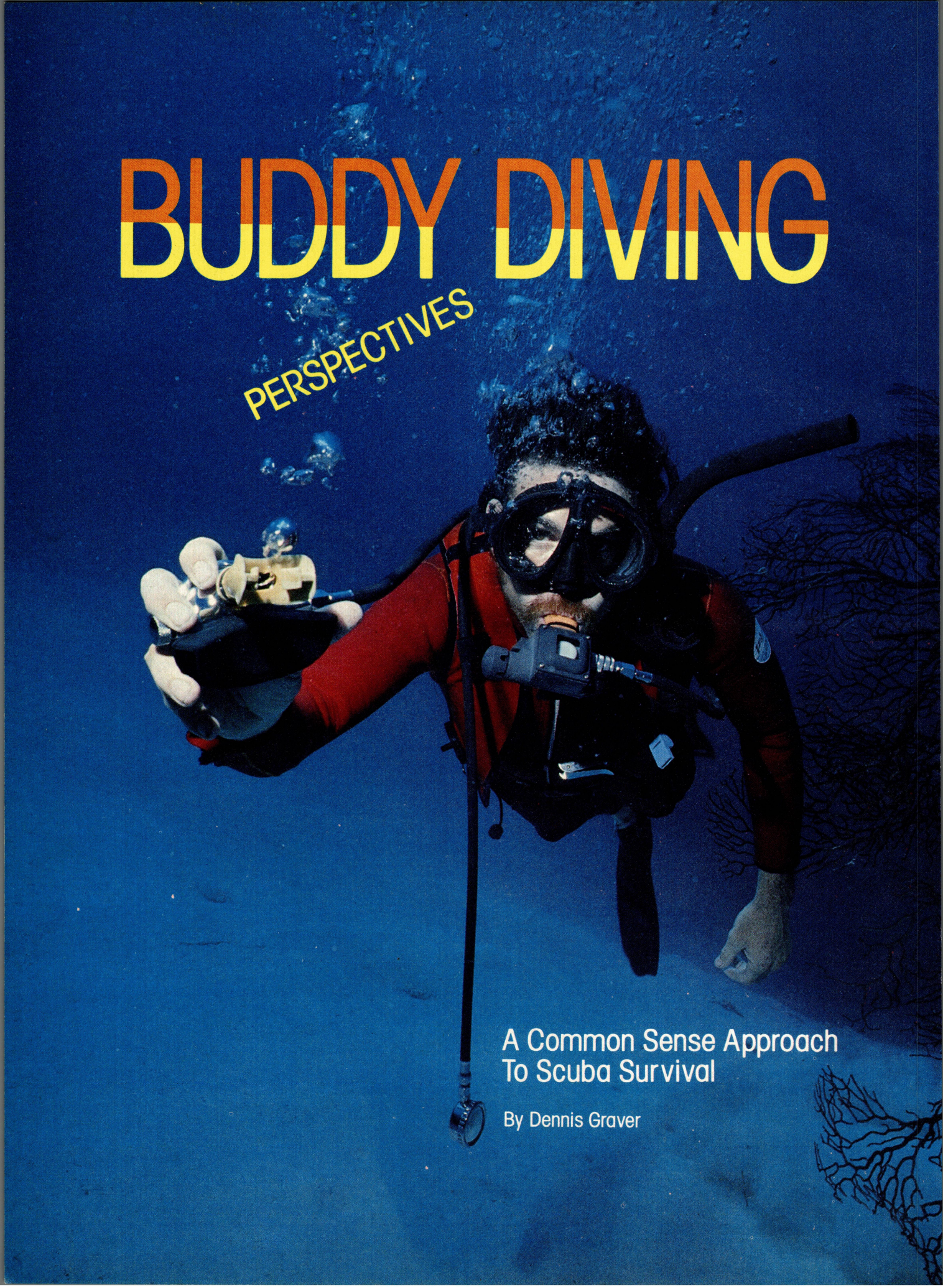
The Coastal Monitoring Covenant

Let us not chop down the tree to acquire the apples.
Or allow a butterfly's birth to turn our eye from the beauty of the cocoon.
Let us value all of Creation not for the purpose that we might use it.
But rather let us value Creation simply because it exists.
For we are caretakers of this planet, with the power to destroy or protect.
We are not spoiled children given toys to break.

Editor's Note: The Coastal Monitoring Program evolved through the joint efforts of four agencies: The Greater Los Angeles Council of Divers, Ocean Projects Section; The Los Angeles County Department of Parks and Recreation, Underwater Unit; The Los Angeles Chapter of the Oceanic Society; The Los Angeles County Department of Beaches.

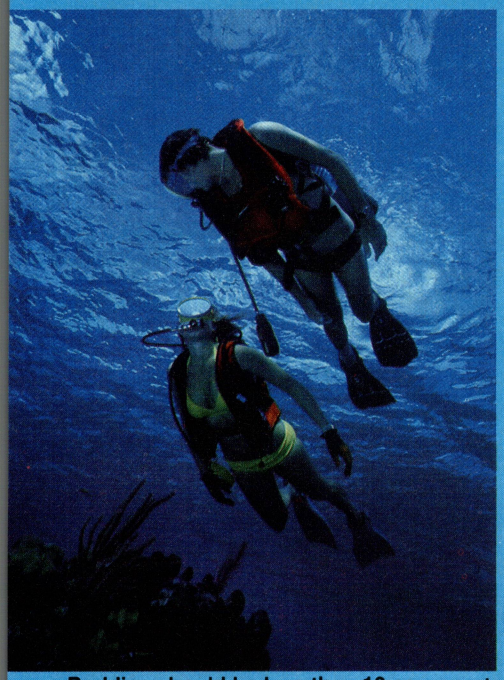
BUDDY DIVING

PERSPECTIVES



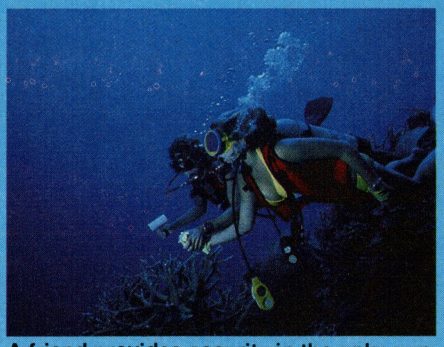
A Common Sense Approach
To Scuba Survival

By Dennis Graver

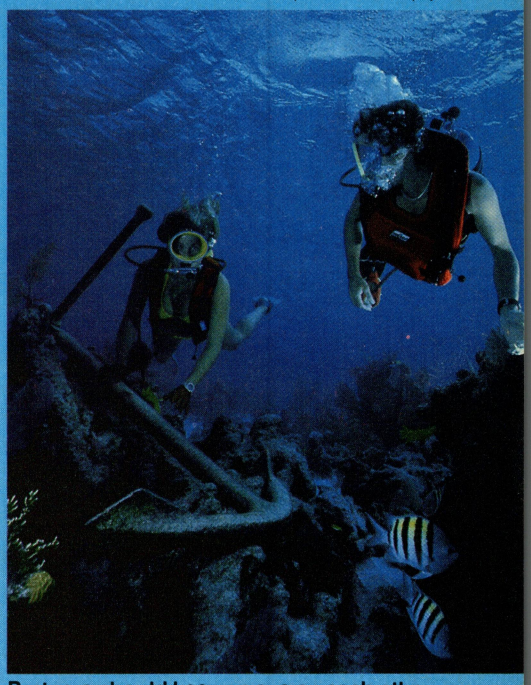


Buddies should be less than 10 sec. apart.

Your buddy can help you don equipment.



A friend provides security in the unknown.



photos/Geri Murphy

Partners should keep an eye on each other.

I was only five feet below the surface. The water was calm and crystal clear. Moving slowly under a narrow ledge, I spied the antennae of a lobster. Closing in, I prepared to catch the creature. The hole opened to my left. Holding my hand next to my head, I moved in steadily but slowly until I was as close as possible. I lunged with my left hand and caught the bug just around a corner in the hole. Pulling and shaking the lobster, I tried to dislodge it from its abode. The urge to breathe began to build within me, so I released my grasp, planning to try again after surfacing and catching my breath. When I tried to pull my hand out of the hole, however, it wouldn't come. My gauge was caught!

It was standard practice for me to wear a depth gauge on my left wrist and to keep my right arm clear for catching lobsters, but the hole opening to the left had caused me to use my left hand. In the excitement of the hunt I forgot about the gauge and now it was caught in the rocks. I pushed my hand back into the hole and attempted to pull it out again without success. By now the urge to breathe was strong. I tucked my chin and swallowed to subdue the impulse within and became aware of hundreds of thoughts racing through my mind. It was terribly difficult to resist the urge to struggle. Mustering up all the calmness possible, I pushed my hand bck into the hole and began extracting it slowly while rotating it carefully from side to side. The gauge kept catching on obstructions here and there, but I managed to work past them one by one. Seconds seemed like minutes. When my hand finally came free, my throat felt as if it had a grapefruit stuck in it. I couldn't hold my breath another second. Popping to the surface, I sucked in huge quantities of fresh, sweet air and uttered a silent prayer of thanks for surviving the terrifying experience.

As I floated on the surface recovering, many thoughts flowed through my mind. I had nearly died. How would it have looked for a dive instructor to be found dead with his hand stuck in a hole in less than ten feet of water? I was diving alone. No one could have assisted me if had lost consciousness. With all my experience and skill, I was sure there were situations where it was quite all right to dive by myself and I had done so many times without consequence. But now, after this close call, I began to wonder . . .

There are those who maintain that people should never dive alone while others contend that diving with or without a companion should be a matter of personal choice. . . that people should not be disparaged because they prefer self-reliance when diving. The fact is that there is no simple policy regarding the buddy system. Whether or not a buddy should be a requirement for a dive is determined by many factors and becomes a complex value judgement. It is not appropriate to say that this decision should be left to the individual diver. Let me point out some reasons why.

Experienced divers are role models for new divers. When old salts engage in solo diving, the practice is soon adopted by the beginners. It should be obvious that this can result in difficulties for the novice. I'll list some of the problems that can be averted with the buddy system: A person is less likely to panic when someone else is present. Equipment problems and entanglements are more easily corrected. A companion also increases awareness by being able to remind one about depth, air supply, breathing pattern and more. The value of problem *prevention* with the buddy system may be greater than the value of rendering assistance after a problem gets out of hand. Are new divers endangered when they try to follow the example of experienced divers who dive on their own? Are the salts increasing the risk for the novice when, as role models, they degrade the buddy system?

There isn't much disagreement concerning the buddy system for new divers. Nearly everyone agrees that novice divers should have buddies. Beyond that, however, controversy enters into the picture. Instructors and experienced div-

ers agree that novices should not be buddied together, but are reluctant to nursemaid newcomers to the sport. Those with experience don't want to be burdened or held back by another person less proficient underwater than themselves.

It is quite common then for the experienced diver to allow a novice to tag along on a dive, but this is a mockery of the buddy system. The experienced diver seldom looks after the novice once they are underwater, and the novice gets little enjoyment out of following someone who seems to be having all the fun. What typically occurs is that the novice can't keep up, stops to look at something and loses contact; or finally decides to seek some enjoyment independently and then ends up diving alone. The novice has been taught to surface and reunite when separated, so the new diver may faithfully carry out this procedure. After waiting at the surface for several minutes alone, the novice may find his partner's bubbles and relocate him or her on the bottom. After this sequence of events has occurred several times, the new diver discovers that buddy contact is unilateral and abandons the buddy system. While most will agree that this just isn't right and that the experienced diver depicted is incredibly selfish, this scenario occurs with alarming frequency. I often wonder how a new diver is supposed to learn how to be a proper buddy.

Part of being mature is being responsible. Unfortunately, people sometimes overlook responsibility while claiming a right. Do people really have the right to dive alone when their actions will improperly influence others or when the decision to dive alone leaves a less capable person unattended? Is it possible that those who argue for self reliance and the right to dive alone are falling short in their responsibility?

I do not favor diving alone. Having dived in many, many different environments, having participated in numerous dive activities for many years, and being a master instructor with stacks of completed log books, I look back on my experience and can recall several instances where I was in trouble while diving alone or where the buddy I had left alone could have used my assistance. A true buddy would have been valuable in each of those situations. It may be that caution and decreased boldness evolve with passing years, but perhaps reflecting upon close calls also develops greater respect for the buddy system.

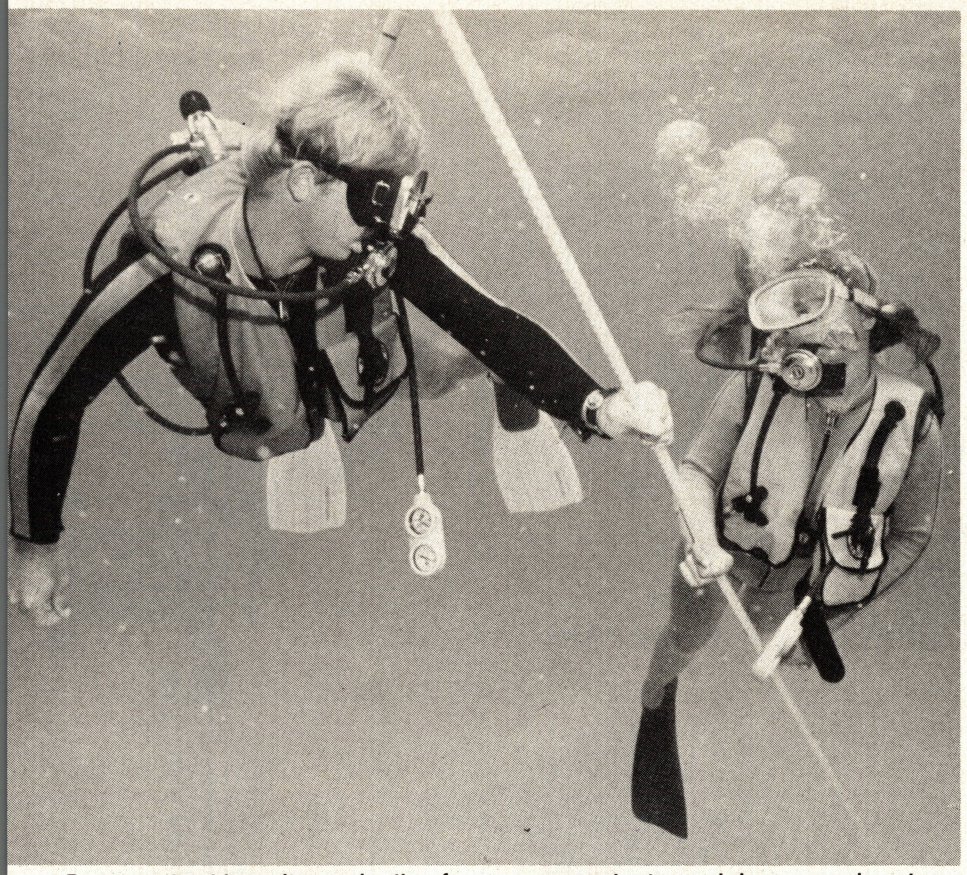
Did you know that five percent of the dive fatalities are caused by unconsciousness underwater owing to a blow on the head? Water is powerful. Surge, current, or surf can slam a diver against rocks and reefs. Tank valves have hit divers in the back of the head during surf exits and divers have had weightbelts, anchors and other heavy objects dropped on them while underwater. How can a diver possibly cope with such problems alone? Various medications and physical problems can also lead to unconsciousness while diving, a condition that is nearly certain to be fatal unless someone is there to assist.

A point that needs defining is: Just when is a person diving alone? It is common for divers to enter the water together, descend, go their separate ways on the bottom, and reunite after the dive. As far as I'm concerned, such divers are diving alone. I'll propose a definition of what buddy diving should be: *The divers are within sight of one another at all times and are able to establish physical contact with each other within ten seconds.* Obviously the distance between divers varies depending upon the underwater visibility, but even in the clearest water, separation should not exceed a distance that cannot be covered in the ten seconds.

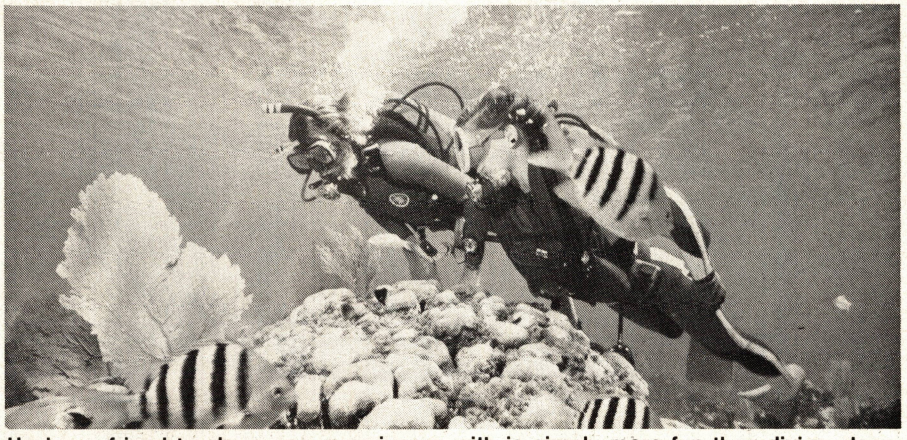
What if someone is watching from

photo/Dennis Graver

In certain situations, a buddy can eliminate those unnecessary hassles that spoil a dive.



Partners should monitor each other for proper ascent rates and decompression stops.



Having a friend to share new experiences with is simply more fun than diving alone.

above as a stand-by diver? Isn't that all right? Many divers like to exhaust their air after their buddy surfaces. Is this diving alone? I say it is, and can point to accident statistics to support my view. In a nutshell, unless two people maintain continuous contact while diving, they are diving alone.

Is our sport so dangerous and must we be so disciplined and pure that one must never dive alone? Probably not, but it is not simply a matter of personal choice in deciding to dive with a partner or independently. At the right time, in the right place, and under the right circumstances one could probably dive alone quite safely. Independent diving should be the rare exception, however, rather than the rule. While diving alone is standard practice for many divers, it should not be. The real crux of the problem with the buddy system lies in making the decision of when it is permissible to dive alone.

If new divers should not, but experienced divers can and do, at what point does one become qualified for solo diving? The answer is not as simple as specifying a certain number of years or dives. Mature, prudent judgement is required to reach a wise decision about solo diving. A person should probably dive with a buddy, but if even considering diving alone, that person should ask himself/herself the following questions:

1) Do I feel healthy and physically fit? 2) Are my dive skills proficient from recent activity? 3) Is my equipment familiar and in good condition? 4) Is the area familiar to me? 5) Are the water conditions favorable? 6) Is it shallow enough for me to reach the surface unassisted if I had no air? 7) Do I have a responsibility to new divers present? 8) Do I tend to panic in tight situations? 9) Is the planned activity relatively safe? 10) Do I feel I could cope with any problems that might arise on this particular dive? 11) Will I be taking an unusual risk by making this dive on my own?

All of these factors and more need to be carefully weighed before deciding to dive independently. While we all have free agency, each of us needs to keep in mind that we are part of the dive community! Our individual example and safety affect others and our influence extends beyond our immediate associates. Diving alone should not be commonplace. The buddy system should remain a standard, strongly encouraged practice.

Could it be that solo diving results because people don't know how to dive together? Maybe there are divers who have not learned the techniques that make it easy to maintain contact while underwater. I feel this is the case. I also feel that new divers are generally not provided with enough information on how to make the system work. If you are one of those who is unfamiliar with the techniques and procedures of buddy diving or who does not realize the benefits of the buddy system, I would like to reference you to Chapter B, Buddy System Techniques, in my book, *Sport Diving A to Z*. If people could dive together easily, I believe they would team up and stay that way much more frequently.

It is difficult to force anyone to dive with a buddy. It is up to you to make the decision. Will yours be mature and responsible? Will you wait until you have a near miss before you reflect on diving alone? Using the criteria described, have you been diving alone when it is really inappropriate? Perhaps it is time to reconsider your dive practices, to get more information, to ponder the subject, and to discuss buddy diving with your companions. I'll close with two requests: (1) Let's support the buddy system, especially for neophytes; and (2) let's make a special effort to assure that new divers learn how to properly use the buddy system. There are going to be abuses to the system, but it's a good system worthy of support.

HELIX AQUAFLASH 22

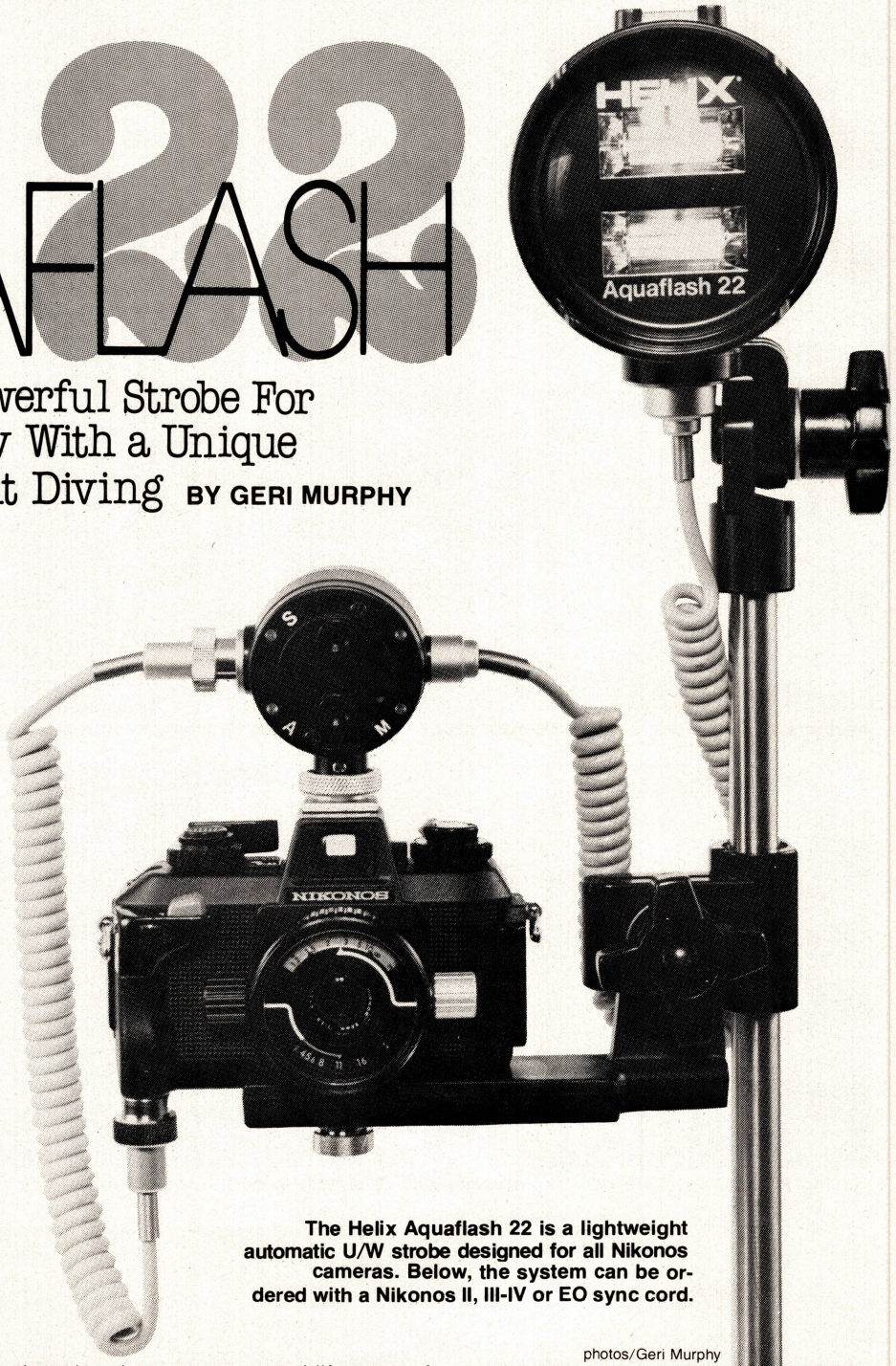
A Quick And Powerful Strobe For Fish Photography With a Unique Feature For Night Diving

BY GERI MURPHY

Helix, one of the largest photographic retailers in the United States, has just introduced an underwater flash manufactured to its own specific design. This revolutionary strobe incorporates several unusual features such as: dual flash tubes; an instrument console with ready light, automatic flash indicator, slave switch, auto/manual switch, and guide number chart; and an automatic flashing beacon for night diving.

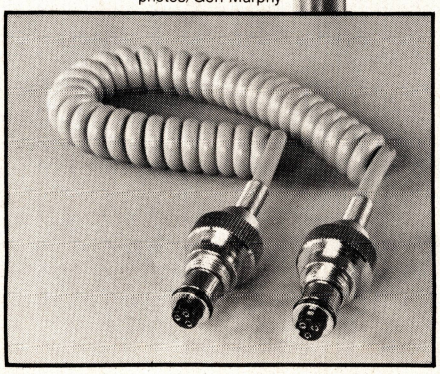
The innovative features contained in the new flash are the brainchild of Paul Schutt, president of Helix. Schutt is an avid scuba diver with 20 years experience, and an expert in underwater photographic technology. He conducts dive tours to many exotic spots in the world, including the Philippines, the Red Sea and Australia. Schutt also teaches underwater photography techniques on many of his trips.

Working with the design engineers from Toshiba of Japan, Schutt sketched out a number of special features which he felt would be useful and practical for the underwater photographer. In turn, Toshiba has produced this special underwater strobe unit called the Helix Aquaflash 22.



The Helix Aquaflash 22 is a lightweight automatic U/W strobe designed for all Nikonos cameras. Below, the system can be ordered with a Nikonos II, III-IV or EO sync cord.

photos/Geri Murphy



DESIGN

Perhaps the most distinctive feature of the Helix flash is that it has dual flash tubes and reflectors in one head. The combined coverage of the two reflectors is an area 70 degrees wide and 54 degrees high. This is more than sufficient for both the Nikonos 35 mm and 28 mm lenses.

Schutt indicates the purpose of the dual flash tubes and reflectors is to provide overlapping and even coverage for the entire field. The dual reflector design provides a slightly softer lighting at close ranges. Another advantage is that the tubes have an expected life span of twice as many flashes since the power is reduced. Should one of the flash tubes fail, the other would then assume all of the electrical load and continue to provide full flash output. The front port of the flash head is a dome type configuration which maximizes the angle of coverage. The flash duration is approximately 1/300 second at full power and 1/1200 second at the quarter power setting. The color temperature of this unit is 5600° Kelvin.

The four position power switch, on/off indicator light and battery compartment

cover are located at the back of the strobe head. The four separate positions for the power switch include: Off; 1/4 power, Full power (Manual or Auto); and flashing beacon (indicated by a zig-zag arrow). Each power position on the switch is a positive click to avoid drift. A large, bayonet mounting type of cap with an O-ring seal allows access to the battery compartment. The Helix flash takes six AA alkaline batteries, positioned in a circle. When the power is switched on at the rear of the flash head, a small red indicator light glows in the center of the switch to indicate the power is on.

The flash head is attached to a 17 inch long stainless steel tubular flash arm. The head can be tilted downward or upward for a full 180 degree range. A large, easy-to-grip, adjustment knob allows the user to tighten the tension on the tilt head mechanism for any angle desired. At the opposite end of the solid flash arm is a swivel and tilt mechanism attached to the flash tray. The flash arm slips into the clamp and is secured by tightening the knob. This adjustment controls the length of the arm, the arm-to-camera angle and the direction the strobe is facing. The flash tray is designed to fit all Nikonos camera models including the Nikonos IV. There is even a spot in the bottom of the flash tray anchor screw for storing the aluminum flash plug from the camera.

Another unique feature of the Helix flash is the large instrument console which can be attached to the top of the flash head, the bottom of the flash tray, or the shoe mount on top of the Nikonos. This instrument console is two and one-half inches in diameter and two inches thick, with a shoe mount fitted to the base. The right side of the console is fitted with a coiled cord synch wire which connects to the camera. The left side has a connector wire (also coiled cord) which goes directly to the flash head. The purpose of the instrument console is to provide the photographer with all of the read-out information necessary for automatic strobe photography, as well as flexibility in switching flash modes.

The rear of the instrument console (facing the photographer) contains a ready light which indicates when the strobe is ready to fire. Next to the ready light is an auto check indicator that flashes when the strobe fires if the subject is within the exposure range of the flash. Above the two indicator lights is a simple chart giving guide numbers for computing f stops topside, using either feet or meters, for three different film speeds, and two different strobe powers (full or one-quarter). The chart also contains recommended aperture settings for when the flash is used in the automatic mode.

The front side of the instrument console contains two switches which operate manual shutters. The top switch is for the slave mode when the Helix flash is being used in conjunction with another strobe. The slave circuit is activated by sliding the switch to the S position. This uncovers the slave sensor. The bottom switch of the console is used to open or close the sensor for automatic flash control. When the switch is set on Automatic (A) the light output is regulated to provide the correct exposure. When this switch is set on M, the strobe will operate in the manual mode like any strobe.

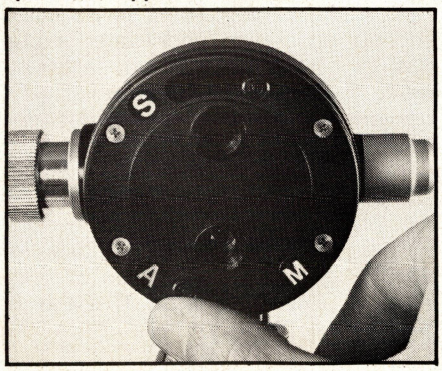
Both the flash head and instrument console are constructed of a high impact plastic compound which appears to be extremely rugged. They are professional black in color. The standard Helix Aquaflash 22 is shipped with a three-pin, O-ring sealed flash connector which will perfectly fit either a Nikonos III or IV. However, the Helix unit can be purchased with a Nikonos II connector or an EO male plug. Furthermore, you can purchase extra coiled cords or various connector designs for quick and easy conversion.

PERFORMANCE

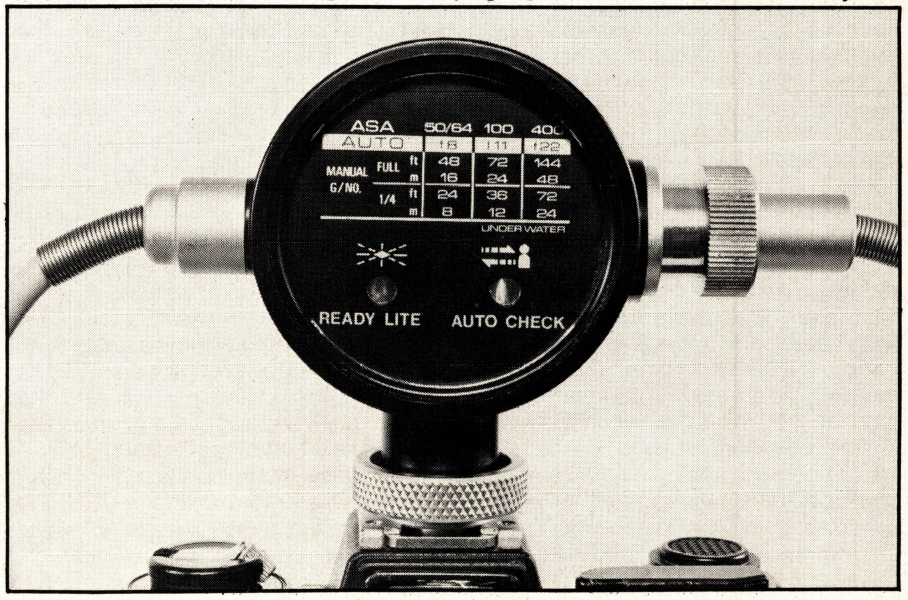
The manufacturer indicates in its literature that a fresh set of alkaline batteries will produce a total of 110 flashes when set on full manual power. SKIN DIVER's test indicated that Helix Aquaflash did much better. SKIN DIVER inserted six Eveready No. E91 AA alkaline batteries and fired the flash at regular one minute intervals. We got a total of 180 flashes out of a set of batteries before the recycle time exceeded 60 seconds. The manufacturer indicates that on automatic flash mode, this unit produces up to 600 flashes because of the energy saving thyristor circuit design. Based on SKIN DIVER's full power/manual flash test, we believe this unit certainly has that kind of capability.

The manufacturer indicates that the average recycle time for the Helix flash is 7 seconds. During SKIN DIVER's flash test it was found that recycle times ran from 6 to 7.5 seconds with the first roll of film (36 flashes). With the second roll the strobe recycled in 7.5 to 8.5 seconds; with the third roll, in 8.5 to 10.5 seconds; with the fourth roll, in 10.5 to 15.5 seconds. About mid-way through the fifth roll of film, recycle time hit the 20 second mark and then rapidly deteriorated to a full 30 seconds toward the end of this roll. In our opinion, the Helix Aquaflash 22 works beautifully for at least three rolls of

Subject side of the instrument console — lower switch is for automatic or manual operation, upper is for slave or normal.



Photographer side of console — the auto check light flashes when the strobe is fired if the subject is within automatic range. The ready light glows when the strobe has recycled.

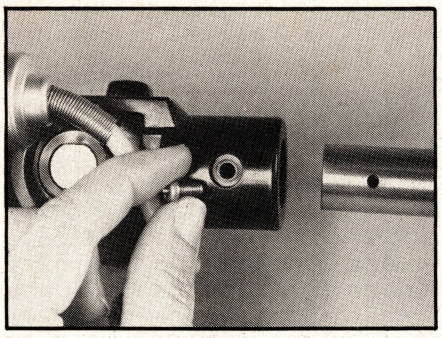


film (manual full power) providing a snappy recycle time. If you are a patient photographer, you will be able to squeeze in a fourth roll of film on the same set of batteries without much difficulty. However, this is a pretty tentative situation and the strobe may cease functioning during the middle of this fifth roll. On the automatic flash mode (A), the Aquaflash could continue working for ten or more rolls of film, depending on how close it is held to the subject. Also, recycle times are frequently faster (one-half to five seconds) on automatic mode.

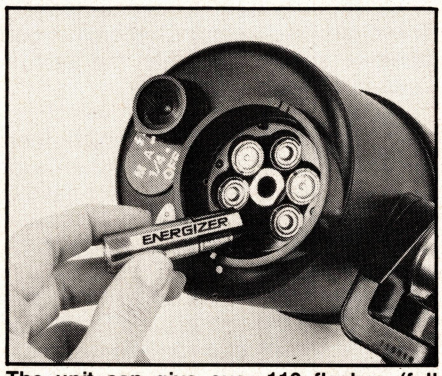
The Helix Aquaflash is a remarkably powerful underwater strobe considering the fact that it operates on AA batteries. Its underwater guide number for ASA 64 film is 22. In fact, this is how the flash unit got its name — the Aquaflash 22. The unit will produce an approximately one f-stop brighter flash than its predecessor, the Toshiba TM-1. On one-quarter power, the unit performs well for macro photography. The aperture setting for macro shots using ASA 64 film is an average f22, when the flash is positioned over the camera head. When used in conjunction with the Nikonos Close-Up Kit, the same flash head position will produce enough light for a setting of f16.

The main feature of the Helix unit is the automatic flash mode. With ASA 64 film, the automatic flash works best at distances of from two to four feet, and in very clear water it will operate out to five feet. The recommended aperture setting for ASA 64 film at these distances is f8 but we found you can use f11 in certain circumstances. SKIN DIVER found that the Helix flash is an ideal partner for the Nikonos 28 mm lens when attempting to shoot fish portraits. The distance range of two to four feet is just about perfect for the 28 mm lens and the automatic flash mode at f8 produces sharp, colorful pictures. The photographer no longer has to worry about constantly resetting the aperture control as the fish move in and out from the camera lens. If you set the 28 mm lens focus at three feet, you have a depth-of-field from two and one-half to four feet at f8. Should you desire greater depth-of-field, switch to a faster film such as Fujichrome 100 or Ektachrome 200. The automatic flash setting for these films is f11 and f16 respectively.

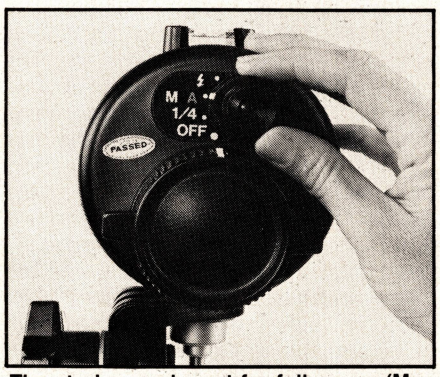
The function of an automatic flash is a fairly simple concept but requires high technology in design. When the photographer squeezes the shutter release, the flash head fires. Light travels from the flash head to the subject and is reflected back to the camera. Naturally, this light is traveling at an incredible speed (more than 186,000 miles per second). When a sufficient amount of light has been reflected from the subject to the camera, a sensor automatically cuts off the electrical power going to the flash tube. The entire process is accomplished in less than a fraction of a second.



The flash arm can be detached from the strobe head by removing one stainless steel screw. Right, the Aquaflash 22 utilizes dual flash tubes for even coverage.



The unit can give over 110 flashes (full power) on a set of six 1.5 volt AA cells.



The strobe can be set for full power (Manual or Auto), ¼ power or flashing beacon.

We found the Helix automatic strobe to perform very well under a variety of conditions. SDM tested the strobe in a swimming pool, in California kelp beds and on Bahamas coral reefs. It worked amazingly well under most all conditions. The only time we could "fool" the auto sensor was when taking photos of a solitary fish in open water. The automatic flash sensor works like an averaging light meter in an automatic exposure camera. The sensor scans the entire picture area and computes an average light value for the lighted and unlighted areas of the picture. The end result is an overexposed fish picture because of the dark area surrounding it. You can easily correct for this problem by simply stopping down the lens aperture one f-stop (change from f8 to f11). Fish photographed against a light or reflective background come out fine. In fact, we found the Helix Aquaflash 22 to be one of the best little fish photography flash units we have tested to date. The simplified flash arm design and featherweight flash head combine to make a surprisingly lightweight unit that is easy to handle in rough water. You can pre-set all exposure controls and then simply point and shoot the camera/flash — with one hand if necessary.

The slave mode on the Helix flash is quite sensitive to a distance of 22 feet. However, the sensitivity of the slave's photo electric cell is directly related to ambient light conditions. As with other slave units, the Helix slave works best in low light situations such as those found at deeper depths.

Still another remarkable feature of the Helix strobe is the automatic beacon flasher. When the unit is switched to the zig-zag arrow, the strobe will put out a continuous low power flash at three to four second intervals. The signal mode can be very handy as a locator beacon on a night dive or as a means to attract the attention of your dive buddy or the dive boat. Since the signal mode uses low power flashes, the power drain is slow and the strobe will run for several hours on a fresh set of batteries. After 180 flashes on a set of batteries, SKIN DIVER found there was still sufficient low level electrical energy to operate the flashing beacon. The power output of the flashing beacon is 1/500 of full power.

In conclusion, SKIN DIVER found the Helix Aquaflash 22 to be a very exciting second generation underwater strobe design. It is ruggedly built and fairly simple to operate. The number of flashes it delivers and several unique features make it an attractive flash unit for the underwater photographer. For the fish photography enthusiast using a 28 mm or 35 mm lens, it is an ideal companion.

The Helix Aquaflash 22 retails for $399.50. For more information write to: Helix, 325 West Huron St., Chicago, IL 60610.

PELICAN DISTRIBUTES COSINA

Cosina, the leading Japanese manufacturer of high-quality optics, has announced that Pelican Products will be the exclusive United States distributor for its new Cosina Marina U/W Camera System.

Cosina USA president, T. Mayama, (center right) shows off the new Cosina Marina U/W System to Pelican Products

president, Dave Parker, (center left), flanked by Jerry Linehan, Pelican vice president sales marketing, (left), and Joe Serina, Cosina vice president sales marketing, (right).

The system is an ultra-compact camera with 35 mm f2.8 lens, programmed electronic shutter and frame-per-second auto winder fitted in a special housing. The system was dive tested to 160 feet.

Pelican Products will market the new camera system through its extensive 1200 strong nationwide dealer network.

For further information contact Pelican Products Inc., 23763 Madison Street, Torrance, CA 90505.

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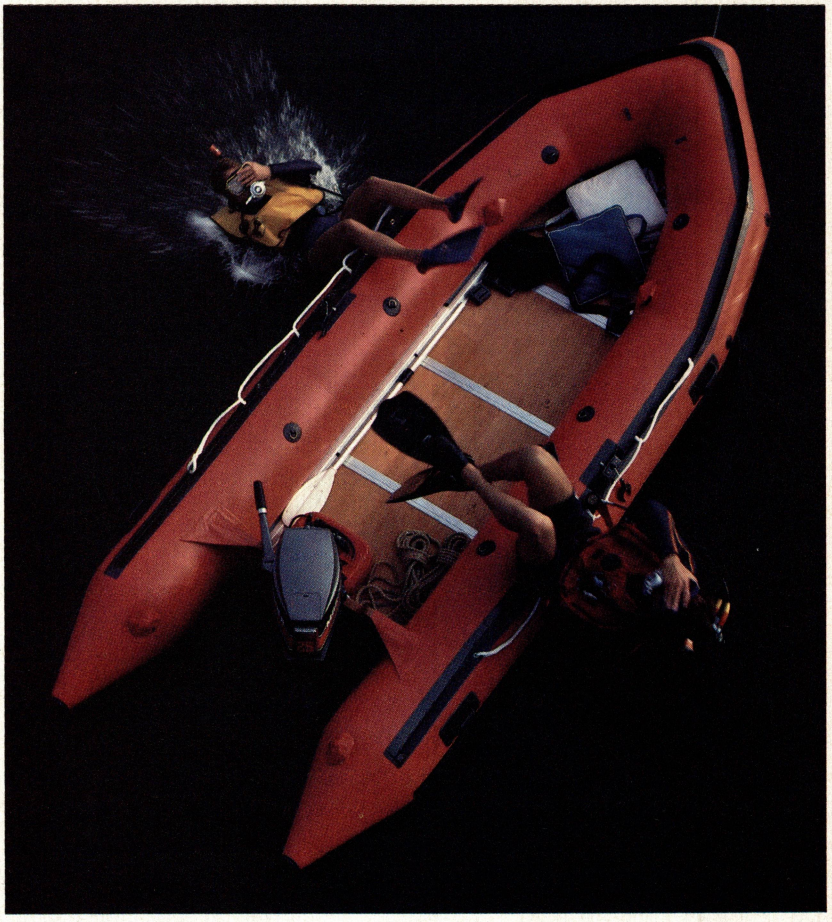

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It's about time...

you learn everything you need to know to buy an U/W watch

Text and photography by George Cozens

It's about time...

Casio, 106

Casio, AA91W

Time . . . an ethereal thing. It cannot be touched, felt, heard, or seen. Yet, it can be sensed: in the motion of the stars, the moon, and the sun; in the transformation of day to night; in the changing of the seasons; and in the growth of living things. Since antiquity, man has shown a keen interest in time — and measuring it has been one of his oldest obsessions.

THE DEVELOPMENT OF WATCHES

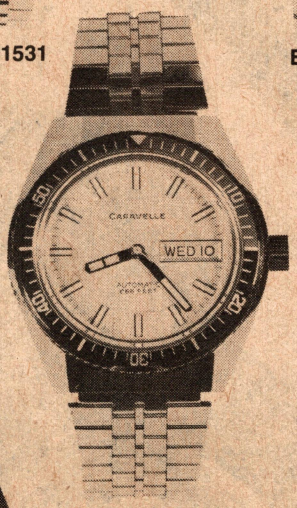
Very early methods of measuring time relied on the moon and sun. The moon was selected first, because its lunar cycles were so obvious. In time (pardon the pun) the sun became the primary source of timekeeping. It was revered in many primitive societies, being regarded as the provider of light, heat and even life itself. Ancient astrologers were probably the first persons to attempt measuring time. Observing the shadows, at sunrise, of sticks stuck vertically into the ground, they discovered that the position of the sun on subsequent mornings changed slightly — moving slowly north, then south, then north again, completing a cycle in 365 days. This was the beginning of our modern calendar. The sun was found to be very consistent, so the astrologers and priests erected permanent markers that were aligned with the rays of light at sunrise on the days of special interest (e.g., religious holidays). One such example is Stonehenge, the remnants of a prehistoric (circa 1800 B.C.) stone structure in England, where parts of the structure are in line with the sun at sunrise on the longest day of the year (i.e., summer solstice).

Eventually, the shadow sticks evolved into sundials, which measured time during daylight hours by either the angle of the shadow cast by the stick (now called a style), or by the length of the

Bulova, 91531

Bulova, 91765

Bulova, 42591



Bulova, 42593

Bulova, 40529

Bulova, 40531

Casio, LW501

Casio, W200

Chronosport, 3006

Chronosport, 3506

An early predecessor of the pocket watch appeared during the Renaissance. It was a small folding sun dial, made of wood, brass, ivory or gold. Opening like a clam shell, the base contained a small compass (for orienting the dial), and once opened, a string stretched from cover to base, casting a shadow on the dial face to indicate the time.

Large, rather crude mechanical clocks were developed by the 13th century A.D., and in the years to follow went through a series of refinements and size reductions. But these clocks were driven by heavy, suspended weights which had to be rewound, or raised, periodically, and so were confined to stationary use. With the invention of the spring, clocks could be made smaller, lighter and more portable.

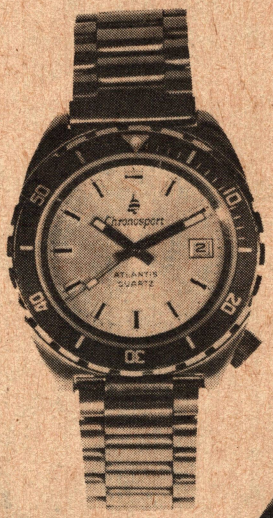
During the 15th and 16th centuries, spring-powered mechanical watches were developed. Early models were housed in ball-shaped, highly decorated cases, suspended from a chain or ribbon around the neck. Fashionable at the time, these round cases were called "musk apples," because they were originally designed to carry small bottles of musk — an early form of personal deodorant.

From the 17th through the 19th centuries, watches underwent a number of changes. They grew smaller and thinner, and became a popular piece of jewelry

shadow. By the time of the Roman Empire, sundials had become so sophisticated that both the shadow's angle and its length were read on a time scale that was corrected for the seasonal variations in the length of daylight during the year.

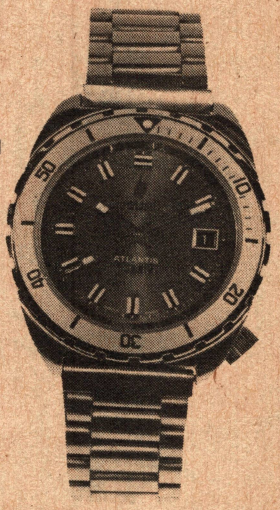
Early in history the need for some sort of personal clock became apparent. During the 5th and 4th centuries, B.C., the length of a man's shadow was used to measure time, in order to establish the hour for meetings and meals. The method was simple. Each person would measure the length of his own shadow, using his own feet. A taller man with a longer shadow would normally have larger feet — so the number of feet (literally) in his shadow was supposed to be the same as the number of feet in the shadow of a shorter person, with smaller feet. If this all sounds silly, consider one additional problem: the poor fellow who wasn't quite smart enough to figure out just how to measure his own shadow, since with each step his shadow would advance an equal distance. I can imagine him trying to step off the length of his shadow until: (a) he couldn't count any higher; (b) he got lost, or tired; (c) both the sun and his shadow disappeared (at dusk); or (d) all of the above.

Chronosport, 3106



Chronosport, 3201

Chronosport, 3801



Chronosport, 3203

It's about time...

Chronosport, 3403

Chronosport, 3903

as their cases were adorned with silver, gold, precious jewels and elaborately enameled designs and paintings. Watch mechanisms .(called movements) improved too: with further developments in the mainspring (that supplies the power), and the escapement (part of the mechanism that regulates the speed of the watch); and with the addition of hairsprings to the balance wheel, and jeweled bearings to the pivot points. During the 19th century, competition for business and mass production techniques resulted in making watches more practical and affordable to common people.

The first wrist watches appeared around 1800, but because they were essentially small pocket watches attached

Chronosport, 3706

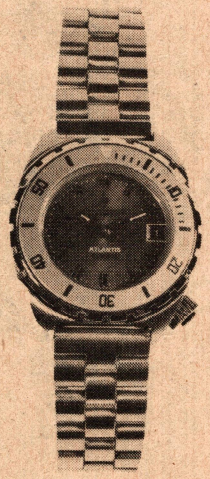
Chronosport, 3401

to bracelets, they did not meet with much success. By 1880, a number of wrist watches were made for German naval officers, but they still didn't catch the public's fancy. Not until after World War I did wrist watches start becoming popular with the public. By the mid-20th century, mechanical (spring-powered) wrist watches had developed to a remarkable level — becoming relatively inexpensive, small and lightweight, reliable and amazingly accurate (to within about 30 seconds per week . . . that corresponds to better than 99.99 percent accuracy — incredible for an instrument that gets as much abuse as a wrist watch).

During the 1950's, the first electric wrist watch appeared. It used a tiny power cell to energize a small electrical coil, which was pulsed periodically to drive the watch mechanism. Later, when transistors were added to the electrical circuit (to improve reliability and accuracy), the watches were called electronic. In 1960, tuning forks were introduced to wrist watch movements as an additional step in regulating the timing frequency and improving accuracy. Then in 1967, quartz crystal wrist watches were made public, giving birth to another generation of watch designs, and opening one more chapter in the long history of timekeeping. With the use of micro-circuits and

Chronosport, 3807

Chronosport, 3306



Chronosport, 3803

Chronosport, 3207

Cressi-sub, 727

Cressi-sub, 729

Cressi-sub, 735

Cressi-sub, 736

other technology from the computer and space age, today's modern watches can do more than we ever thought possible just a few years ago, and certainly more than the wildest pipe dreams of the early watchmakers.

PRICE/APPLICATION

In order to get a better idea of what's available, and to aid in the comparison of watches included in this article, let's look at the following considerations.

Price is just about the first consideration in the comparison of any product, but it's certainly not the only factor. After seeing what's on the market you may find yourself tempted to dig deeper into your budget, in order to get a little more expensive watch, that looks more stylish, will go deeper, has a few more do-dads, etc.

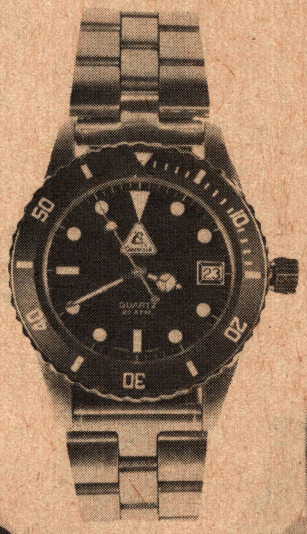
Application is also a point to remember. Will the watch be used for dress wear as well as diving, or will it be confined to diving alone? In the former case, something more fashionable may be desired, so appearance of the watch case and bracelet (or strap) is worth considering, as well as the watch's ability to function satisfactorily while diving. Besides appearance, is the bracelet (or strap) adjustable enough to wear on your bare wrist, as well as over your wetsuit sleeve, if you so choose? If the watch will only be worn for diving, then appearance is less important than such qualities as reliability, rugged construction, ease in reading, etc.

MOVEMENT

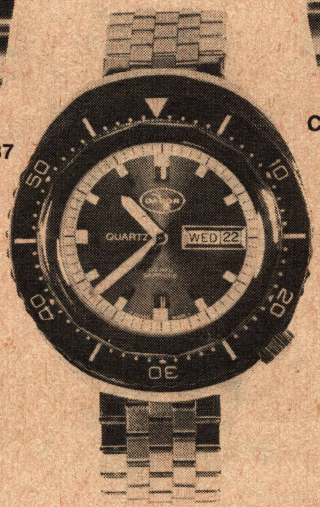
Movement is the term applied to the internal mechanism of the watch . . . it is what makes the watch tick. Currently, movement refers to all watch mechanisms and/or circuits, even though some of the newer electronic watches don't contain any moving parts, nor do they tick.

The traditional time-honored movement is the spring-powered mechanical movement. The mainspring, which supplies the power, is either wound by hand, via the crown in manual models, or wound automatically via a ratchet-type mechanism which is activated by normal wrist motion while being worn. These models are called self-winding, automatic, or perpetual. To prevent overwinding and subsequent breakage of the spring, some watchmakers incorporate a clutch design (described as an "unbreakable mainspring") which prevents winding of the spring to its breaking point. Once wound, the mainspring is allowed to slowly unwind, in small increments, controlled by the escapement (the mechanism that regulates the speed of the watch). The rotation of the unwinding mainspring is then conveyed through a

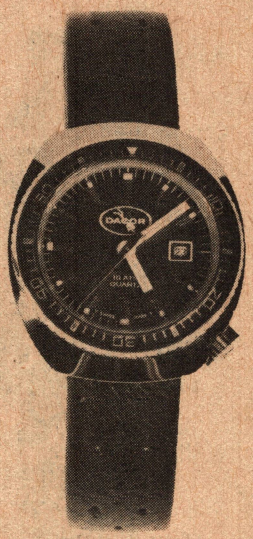
Cressi-sub, 737



Cressi-sub, 738



Dacor, UWM-1



Dacor, UWL-2

It's about time...

series of reduction gears to the hands of the watch. Often, the quality of a mechanical watch (whether spring or battery-powered) is expressed in the number of jewels it has — the more jewels, the higher the quality. These jewels refer to the jeweled bearings in the movement — typically, small cut pieces of ruby, garnet, sapphire and/or diamond, which provide a very hard, but brittle, surface on which the pivots of the shafts can rotate, thereby reducing friction and wear, and increasing accuracy. But because the jewel pieces are brittle, they are susceptible to breakage from shock, so some watchmakers mount them in a special, shock-proof assembly, called Incablock.

Heuer, 980.006

Heuer, 980.008

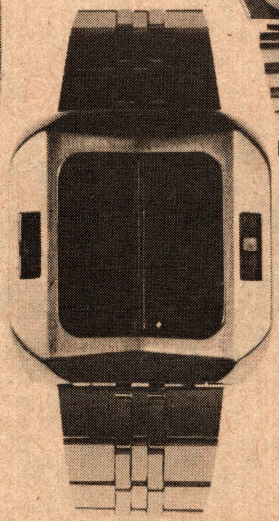
Heuer, 844

Heuer, 980.005

Heuer, 756

Heuer, 980.004

Dacor, UWM-3



Divetime, Divemaster

ELECTRIC VS SPRING POWER

Although the newer electronic watches have seemed to upstage the conventional spring-powered mechanical watches in recent years, the older designs still provide some nice advantages. Because there is no battery, there is no need to replace it periodically — an advantage if you do some extended traveling, especially to remote locations where batteries and service may be hard to find. Also, with no battery, there is no problem of battery leakage and corrosion during long-term storage. Some spring-powered mechanical models can go for longer intervals between servicing. It is not advisable to exceed the manufacturer's suggested service intervals by much, however, since watertight seals, and lubricants in the movement, can deteriorate with age.

In modern electronic watches, a tiny power cell (commonly called a battery) supplies power to the circuit, containing an oscillator (which oscillates at high frequency), and a frequency divider (which reduces the frequency down to one pulse per second — a frequency of one Hertz). If the watch has a conventional dial and hands (called an analog display), this one Hertz signal pulse is used

Heuer, 980.011

Heuer, 980.013

Heuer, 980.014

Heuer, 980.015

to drive a stepping motor which is connected by gears to the second hand, so that this hand sweeps through a one-second division on the dial face with each pulse. Reduction gears are then used to rotate the minute and hour hands (and, possibly a date indicator) at their respective rates. Some watchmakers use jeweled bearings in their electronic analog watches — but because there are fewer moving parts and less wear here, than in similar mechanical watches, fewer jewels are needed.

If the watch has a digital display (actual numbers, or digits, are shown), the electronic circuit is more complex, because it must now provide signal pulses at each second, as well as each minute and hour, and in some cases, each day and month, too. All of these signal pulses are finally converted into figures in the display module by means of a decoder in the circuit.

If the watch has a quartz crystal movement, the electronic circuit is modified, somewhat. In this case, the electronic oscillator excites a tiny, precisely cut quartz crystal, causing it to vibrate at a very stable, resonant frequency (typically 32,768 Hertz). This frequency is then reduced by the frequency divider, as before. It is the stability of the quartz crystal's resonant frequency that allows the watch to be so accurate (guaranteed by some manufacturers to be within one minute per year, or about 1.2 seconds per week).

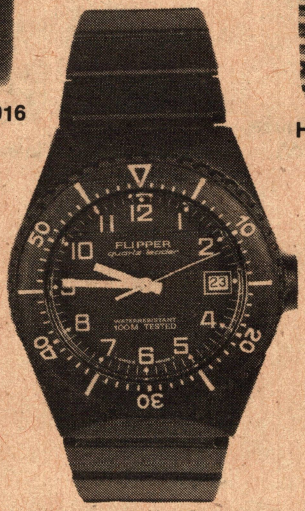
ACCURACY/RELIABILITY

Accuracy is certainly a strong point with the newer electronic watches, although some experts contend that quartz crystals and power cells can be more affected by temperature extremes than their mechanical counterparts — a possible consideration if you plan to dive with an exposed watch in frigid waters. Freedom from having to wind the watch is another advantage of electronic models, but power cell replacement may be inconvenient to some owners. Many of the watches in this survey require cell replacement annually, but some will operate up to five years on a single cell, and one (Divetime's Divemaster) has a rechargeable cell that should never need replacing (it is recharged by solar and incandescent light energy).

A lot of emphasis is placed on accuracy, but for strictly diving applications this emphasis is often misplaced. The measurement of time is important to safe diving. But for sport diving, extreme accuracy in a timepiece is not normally required. Inaccuracies of several seconds or more per hour would be no problem

Heuer, 980.016

Heuer, 980.024



DWS Marketing, RQ375

DWS Marketing, RQ875

It's about time...

when compared to the potential errors involved with other instruments vital to dive safety (in particular the depth gauge and the submersible pressure gauge).

More important in dive watch selection is reliability. Just how dependable is the watch? A difficult question to answer by looking at watches, you can, however, get some idea by talking with other divers, and with sales personnel at good dive shops. Inquire about customer satisfaction with the watches, problems that have occurred, and, perhaps, their own personal experiences. And while you're at it, ask about the manufacturer. How do they respond to consumers' problems? How frequently is routine watch service recommended? How costly is this service? And, what is the normal turn-around time (i.e., how long will you be without your watch while service is being performed)?

Princeton Tectonics, TEC660W

Pulsar, KS039

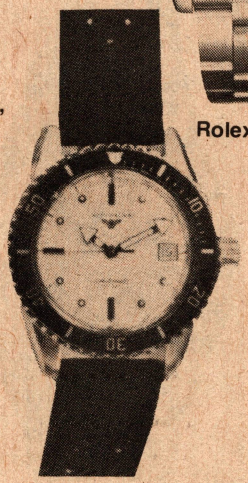
Princeton Tectonics, TEC1800

Princeton Tectonics, TEC660

Palmer House, Wintron

Rolex, 166500

DWS Marketing, Innocron



Longines-Wittnauer, 26630

WATER RESISTANCE

Water resistance is another important consideration. To be labeled water resistant, watches must meet certain government standards: they must prevent the entry of water while submerged for at least five minutes, under an atmospheric pressure of 15 psi (atmospheric pressure at sea level is 14.7 psi), and for another five minutes under a total pressure of 50 psi (corresponding to a depth of about 79 feet in sea water). Most of the dive watches have been depth-tested far beyond these requirements. According to many watchmakers, the biggest cause of leakage is not the fault of the watch, but of the owner, who (after making adjustments, or winding the watch) forgot to secure the crown before exposing the watch to water. In most watches (with crowns, anyway), the crown must be inserted completely to ensure a water-tight seal. For additional protection, a number of watches have screwdown crowns to prevent accidental opening, and protective shoulders, to guard against breakage of the crown or stem. Some other watches have the crown placed at the 5

Pulsar, KF011

Pulsar, KZ301s

Pulsar, KP047

Pulsar, KP071

o'clock position (instead of 3 o'clock) to improve comfort to the wearer, and provide protection for the watch.

WATCH FACE

Another choice to make is the type of display: analog or digital. In a few cases the choice is easy — time appears in both analog and digital modes. In the rest, either one or the other must be selected. The analog display is preferred by some divers because it is familiar to them. Most analog watches have luminescent hands mounted above a contrasting dial face (to allow reading in low light conditions), and rotating bezels circling the crystal, to be used as an elapsed time indicator. A growing number of watchmakers incorporate one-way ratchets in their bezels, to prevent turning them in an unsafe direction.

Digital displays are available in two different varieties: LED and LCD. The LED stands for light-emitting diode, a type of solid-state device which emits light when conducting electricity. Because LED's require a relatively high current drain on the power cell, the display is normally dark (off), until a button is pushed to light the numbers momentarily. In darkness, as well as in most daylight conditions, the LED numerals are bright enough to read directly, but the watch does require one hand to light the display and permit reading (a possible inconvenience should both hands be busy).

The LCD (liquid crystal display) is just that — a liquid crystal sandwiched between two thin sheets of glass. The liquid is either transparent or opaque, depending on whether or not an electric charge is applied to it. A reflective surface behind the display allows ambient light (from an external source) to be reflected out when the liquid is transparent. LCD's require so little current (low battery drain), that they can be used for continuous display. Should the ambient light level get too low (e.g., on a deep or night dive), the LCD would be hard to read, without using some additional light. For this reason, some watchmakers have built in a miniature, push-button operated lamp to illuminate the display when needed. (Of course, this requires one hand to operate.)

CRYSTALS

Watch crystals generally fall into two categories: plastic — which scratches easily, but is easy to polish out; and mineral glass — harder to scratch, and harder to correct. One exception is Dacor's UWM-1, which offers a sapphire crystal.

FEATURES

In addition to the features already described, a few watches offer some interesting bonuses: Bulova's 91531 has a small capillary depth gauge tucked inside its bezel; Chronosport's 3306 and

Pulsar, KP075s

Pulsar, KP095

Pulsar, KP109

Pulsar, KP110

It's about time...

3401, and Heuer's 980.024, provide a 24 hour clock (set to a second time zone if desired), as well as stopwatch functions; Casio's three 106 models have 24 hour time, stopwatch, countdown-timer and alarm functions; Pulsar's KS039 and KF011 provide dual time zone, stopwatch, and alarm capabilities; and Divetime's Divemaster can display a speed reference number to help the owner adjust the watch's accuracy. A large number of watches offer the date, and many, the day and date.

Modern timepieces are something to behold (and even to wear), but their increasing complexity reminds me of an amusing episode. Prior to the 17th century, watches had only one hand — an hour hand. Later, as accuracy improved, a minute hand was added, which prompted complaints from the critics that two hands on the same watch would be overly confusing. These same critics are probably turning over in their graves at the thought of the technological advances, and sophisticated features on our present watches. There does exist, however, the possibility that we can get a little too carried away with the complexity of our timing devices. If it appears that a particular watch might be too confusing to use underwater, then look, perhaps, for something simpler. Diving safety should be the deciding factor. How simple or how complex a watch should be, depends on the user. (I have a multi-function watch, and I just love it!)

Swisswave, 3613SG

Seiko, 60597

Seiko, XP007

Scubapro, 40-021-000

Scubapro, 40-022-000

Pulsar, KP111

Pulsar, UE007s

CARE

A dive watch can represent a sizeable investment for any diver. To protect that investment and improve safety, proper care of the watch is highly recommended. It can add years of service to your watch's life (and, perhaps, yours too!)

1. Read the manufacturer's instructions — the company knows its product best and wants you to get satisfactory performance from it.

2. Check the warranty. All new watches come with a limited warranty (generally excluding damage from normal wear, home repairs, and abuse), with periods ranging from one to five years. Some watchmakers will extend the warranty for an additional fee, or if service is performed by them.

3. Although some power cells will last up to five years, you may consider having the watch's seals checked at more frequent intervals, to ensure watertight integrity. Typically, service intervals run from one to two years, to allow for battery replacement, mechanism lubrication, and inspection of the seals. You may also

DIVE WATCH MANUFACTURERS

MANUFACTURER	MODEL # OR NAME	BRACELET OR STRAP	POWER SOURCE	MOVEMENT	CASE MATERIAL	CRYSTAL MATERIAL	CROWN	PRESSURE TESTED TO	ROTATING BEZEL	DIAL FACE/ COLOR	READOUT ANALOG/ DIGITAL	MEN'S/ WOMEN'S	RETAIL PRICE	WARRANTY (YRS)
Bulova Watch Co.	40529	Rubber	Battery	Quartz	SS*	Plastic	R*	333 ft.	One way	Black	A-L*	W	$100	1
	40531	Rubber	Battery	Quartz	SS	Plastic	R	333 ft.	One way	Gray	A-L	W	100	1
	42591	Rubber	Spring	Self winding	SS	Plastic	R	666 ft.	Yes	Gray/black	A-L	M	85	1
	42593	Stainless	Spring	Self winding	SS	Plastic	R	666 ft.	Yes	Gray/black	A-L	M	95	1
	91531	Stainless	Battery	Quartz	Black/SS	Plastic	R	666 ft.	One way	Black	A-L	M	225	1
	91765	Stainless	Battery	Quartz	SS	Mineral	R, O*	333 ft.	Yes	Black	A-L	M	125	1
Casio Distributors:	106	Rubber/SS	Battery	Electronic	SS/Plastic	Mineral	Buttons	330 ft.	None	Light green	D-LCD w/light	M	$ 37/55	1
DWS Marketing	AA91W	Stainless	Battery	Electronic	SS	Mineral	Buttons	164 ft.	None	Light green	D-LCD w/light	M	80	1
On The Run	LW501	Plastic	Battery	Electronic	SS	Mineral	Buttons	164 ft.	None	Light green	D-LCD w/light	W	50	1
R.B. Athletic Sys.	W200	Plastic	Battery	Electronic	Plastic/SS back	Mineral	Buttons	330 ft.	None	Light green	D-LCD w/light	M	40	1
Chronosport, Inc.	3006	Plastic	Spring	Self winding	SS	Plastic	R	660 ft.	One way	Dark blue	A-L	M	$145	1
	3506	Plastic	Spring	Self winding	SS	Plastic	R	660 ft.	One way	Dark blue	A-L	W	155	1
	3106	Nylon	Battery	Quartz	SS	Plastic	R	660 ft.	Yes	Black	A-L	M	140	1
	3201/3801	Stainless	Battery	Quartz	SS	Mineral	R, O	660 ft.	One way	Silver	A-L	M/W	250	5
	3203/3803	Stainless	Battery	Quartz	SS	Mineral	R, O	660 ft.	One way	Blue	A-L	M/W	250	5
	3207/3807	Stainless	Battery	Quartz	SS	Mineral	R	990 ft.	One way	Black	A-L	M/W	230	5
	3306	Nylon	Battery	Quartz	Black/SS	Mineral	R	330 ft.	One way	Black	A-L & D-LCD	M	350	5
	3706	Nylon	Battery	Quartz	Black/SS	Mineral	R	660 ft.	One way	Black	A-L	W	245	5
	3401	Gold/SS	Battery	Quartz	Gold/SS	Mineral	R	330 ft.	One way	Black	A-L & D-LCD	M	550	5
	3403/3903	Gold/SS	Battery	Quartz	Gold/SS	Mineral	R, O	660 ft.	One way	Gold	A-L	M/W	395	5
Cressi-sub	727	Rubber	Spring	Self winding	SS	Plastic	R	630 ft.	One way	Black	A-L	M	$180	1
	729	Rubber	Spring	Self winding	SS	Plastic	R	630 ft.	One way	Black	A-L	W	200	1
	735	Gold/SS	Battery	Quartz	Gold/SS	Mineral	R	630 ft.	One way	Black	A-L	M	320	1
	736	Gold/SS	Spring	Self winding	Gold/SS	Mineral	R	630 ft.	One way	Black	A-L	W	320	1
	737	Stainless	Spring	Self winding	SS	Mineral	R	660 ft.	One way	Black	A-L	M	250	1
	738	Stainless	Battery	Quartz	SS	Mineral	R	630 ft.	One way	Black	A-L	M	250	1
Dacor Corp.	UWM-1	Stainless	Battery	Quartz	SS	Sapphire	R, O	3300 ft.	Yes	Gray	A-L	M	$335	1
	UWL-2	Plastic	Battery	Quartz	SS	Mineral	R, O	990 ft.	Yes	Green	A-L	W	220	1
	UWM-3	Plastic	Battery	Quartz	SS	Plastic	R	825 ft.	Yes	Black	A-L	M	200	1
Divetime Ind.	Divemaster	Stainless	Solar/rechg. battery	Electronic	Plas. module, SS frame	Plastic	Sliding magnets	750 ft.	None	Side display	D-LED	M	$130/ 160	2
Heuer	756	Plastic	Spring	Self winding	SS	Mineral	R	660 ft.	One way	Black	A-L	W	$185	1
	844	Plastic	Spring	Self winding	SS	Mineral	R	660 ft.	One way	Black	A-L	M	185	1
	980.004	Stainless	Battery	Quartz	SS	Mineral	R, O	660 ft.	One way	Black	A-L	M	245	1
	980.005	Plastic	Spring	Self winding	SS	Mineral	R	660 ft.	One way	Orange	A-L	M	185	1
	980.006	Plastic	Battery	Quartz	SS	Mineral	R	660 ft.	One way	Black/orange	A-L	M	215	1
	980.008/.011	Plastic	Battery	Quartz	SS	Mineral	R	660 ft.	One way	Black/orange	A-L	W	215	1
	980.013/.014	Plastic	Battery	Quartz	SS	Plastic	R	660 ft.	One way	Black/orange	A-L	M	205	1
	980.015/.016	Plastic	Battery	Quartz	SS	Mineral	R	660 ft.	One way	Black/orange	A-L	W	205	1
	980.024	Stainless	Battery	Quartz	SS	Mineral	R	660 ft.	One way	Black	A-L & D-LCD	M	300	1
DWS Marketing	RQ375/RQ875	Plastic	Battery	Quartz	Plastic	Mineral	R	330 ft.	Yes	Black	A-L	M/W	$ 80	1
	Innocron	Plastic	Battery	Quartz	SS	Plastic	R	165 ft.	Yes	Black	A-L	M/W	60	1
Longines-Wittnauer	26630	Rubber/ Gold stainless	Spring	Self winding	SS	Plastic	R	200 ft.	Yes	White	A-L	M	$165/ 195	1
Palmer House	Wintron	Stainless	Electronic	Quartz	SS	Mineral	Buttons	N/A	None	Light green	D-LCD w/light	M	$ 40	½
	Unical	Stainless	Electronic	Quartz	SS	Mineral	Buttons	N/A	None	Light green	D-LCD w/light	W	30	½
Princeton Tectonics	TEC1800	Stainless	Battery	Quartz	SS	Mineral	R	1800 ft.	One way	Black	A-L	M	$319	5
	TEC660	Stainless	Battery	Quartz	SS	Mineral	R, O	660 ft.	One way	Black	A-L	M	220	5
	TEC660W	Stainless	Battery	Quartz	SS	Mineral	R, O	660 ft.	One way	Black	A-L	W	225	5
Pulsar	KS039	Stainless	Battery	Quartz	SS	Mineral	Buttons	330 ft.	None	White	D-LCD w/light	M	$ 85	1
	KF011	Stainless	Battery	Quartz	SS	Mineral	Buttons	330 ft.	None	Light green	D-LCD w/light	M	85	1
	KZ301s	Rubber	Battery	Quartz	SS	Mineral	R	450 ft.	Yes	Black	A-L	M	160	1
	KP047	Stainless	Battery	Quartz	SS	Mineral	R	330 ft.	Yes	Gold	A-L	M	135	1
	KP071	Stainless	Battery	Quartz	SS	Mineral	R	330 ft.	Yes	Black	A-L	M	135	1
	KP075s	Rubber	Battery	Quartz	SS	Mineral	R	330 ft.	Yes	Black	A-L	M	135	1
	KP095	Stainless	Battery	Quartz	SS	Mineral	R	330 ft.	None	Black	A-L	M	100	1
	KP109	Stainless	Battery	Quartz	SS	Mineral	R	330 ft.	None	Black	A-L	M	125	1
	KP110	SS/Gold	Battery	Quartz	SS/Gold	Mineral	R	330 ft.	None	Gold	A-L	M	150	1
	KP111	SS/Gold	Battery	Quartz	SS/Gold	Mineral	R	330 ft.	Yes	Black	A-L	M	155	1
	UE007s	Rubber	Battery	Quartz	SS	Mineral	R	450 ft.	Yes	Black	A-L	W	150	1
Rolex	551300	Stainless	Spring	Self winding	SS	Plastic	R	1000 ft.	Yes	Black	A-L	M	$770	1
	168000	Stainless	Spring	Self winding	SS	Plastic	R	1000 ft.	Yes	Black	A-L	M	950	1
	168080	18K Gold	Spring	Self winding	18K Gold	Plastic	R	1000 ft.	Yes	Black/blue	A-L	M	8950	1
	166500	Stainless	Spring	Self winding	SS	Plastic	R	2000 ft.	Yes	Black	A-L	M	995	1
	166600	Stainless	Spring	Self winding	SS	Plastic	R	4000 ft.	Yes	Black	A-L	M	995	1
	T940100	Stainless	Spring	Self winding	SS	Plastic	R	660 ft.	Yes	Black	A-L	M	450	1
	T941100	Stainless	Spring	Self winding	SS	Plastic	R	660 ft.	Yes	Black	A-L	M	470	1
	T909100	Stainless	Spring	Self winding	SS	Plastic	Not R	330 ft.	Yes	Black/blue	A-L	M, W	400	1
	T912100	Stainless	Spring	Self winding	SS	Plastic	Not R	165 ft.	Yes	Silver/blue	A-L	M	395	1
Scubapro	40-021-000/ 40-022-000	Rubber	Battery	Quartz	SS	Mineral	R	1650 ft.	One way	Black	A-L	M	$270	1
Seiko	XP007	Rubber	Battery	Quartz	SS	Mineral	R	500 ft.	Yes	Black	A-L	W	$195	1
	60597	Rubber	Battery	Quartz	SS	Mineral	R, O	500 ft.	Yes	Dark blue	A-L	M	250	1
	60583	Rubber	Battery	Quartz	T*	Mineral	R, O	2000 ft.	Yes	Black	A-L	M	595	1
	60585	Rubber	Battery	Quartz	SS	Mineral	R, O	1000 ft.	Yes	Black	A-L	M	350	1
	FY117M	Stainless	Battery	Quartz	SS	Mineral	R, O	300 ft.	Yes	Black	A-L	M	195	1
	FY119M-FY121M	Stainless	Battery	Quartz	SS	Mineral	R, O	300 ft.	Yes	Blk/yellow	A-L	M	215	1
	DE095	Stainless	Spring	Self winding	SS	Mineral	R, O	500 ft.	Yes	Black	A-L	M	165	1
Swisswave	3611	Plastic	Battery	Quartz	SS	Plastic	R	660 ft.	Yes	Black or red	A-L	M	$140	5
	3612	Plastic	Battery	Quartz	SS	Mineral	R	660 ft.	Yes	Black or red	A-L	M	160	5
	3621	Plastic	Battery	Quartz	SS	Plastic	R	660 ft.	Yes	Black	A-L	M	155	5
	3613SG	Plastic	Battery	Quartz	SS	Mineral	R	660 ft.	Yes	Gold	A-L	M	185	5
	3614BG	Plastic	Battery	Quartz	Blk/SS	Mineral	R	660 ft.	Yes	Black	A-L	M	195	5
	6511	Plastic	Battery	Quartz	SS	Mineral	R	660 ft.	Yes	Orange	A-L	W	170	5
U.S. Divers	7336-00	Stainless	Battery	Quartz	SS	Mineral	R, O	990 ft.	One way	Slv/blk/or	A-L	M	$368	1
Time Unlimited	1004	Plastic	Battery	Quartz	Plas. module	Plastic	R	330 ft.	One way	Black	A-L	M	$109	1
	1006	Plastic	Battery	Quartz	Plas. module	Plastic	R	330 ft.	One way	Silver	A-L	M	99	1
	2001	Plastic	Battery	Quartz	Plas. module	Plastic	R	330 ft.	One way	Silver	A-L	M	139	2
	2006	Plastic	Battery	Quartz	Plas. module	Plastic	R	330 ft.	One way	Black	A-L	M	134	2

A-L=Analog-Luminescent; R=Recessed; O=Offset; SS=Stainless Steel; T=Titanium

It's about time...

consider having a battery replaced early, if you think it might die during an extended trip. Carrying extra batteries and doing your own replacement is not recommended.

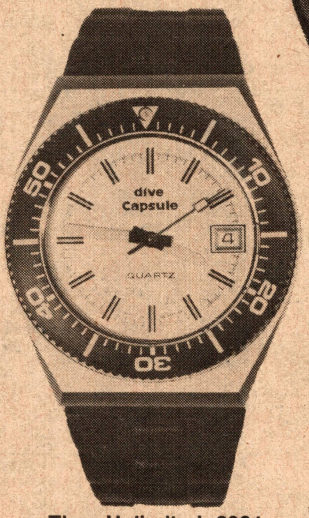
4. Rinse with cool fresh water after dives (pool and ocean), rotating the bezel (if any) to flush out any sand, silt or salt. Be careful of using hot, soapy water on watches (even while taking a shower or bath). These conditions can promote leakage in some watches.

5. Inspect for internal moisture and any damage that might cause leakage — if noticed, the watch should be serviced as soon as possible.

6. After winding, or making adjustments, be certain the crown is secured (pushed in, or screwed down tightly).

7. Try to avoid hard shocks or temperature extremes as either of these might damage the movement.

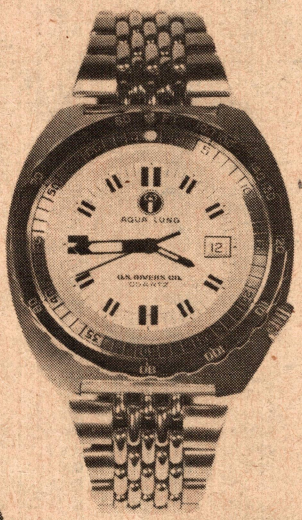
Time Unlimited, 2006



Time Unlimited, 2001

Time Unlimited, 1006

Time Unlimited, 1004



U.S. Divers, 7336-000

Swisswave, 3614BG

Swisswave, 6511

8. In preparation for long storage periods, relieve the tension in the mainspring (of a spring-powered movement) by letting it wind down. In electronic analog watches, you can pull out the crown slightly, to stop the hands and reduce the drain on the power cell. Don't forget to secure the crown before use, however.

9. In order to get the utmost accuracy from your watch, you need to set it with an accurate time standard. Standard time from the local telephone company is only approximate — if you have no better source, then try to use a time signal close to the whole hour (e.g., 8:00, 9:00, etc.) — I've been told this procedure is more accurate. Timing ticks on AM and FM radio stations are not always accurate, either. Your best bet is to use the calibrated time signals broadcast on shortwave channels for marine navigators (e.g., in the continental United States, WWV, transmitted from the U.S. Naval Observatory, Ft. Collins, CO, on frequencies 2.5, 5.0, and 10.0 Mega Hertz).

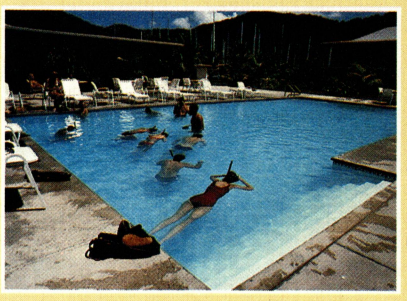
10. Protect your watch while diving, by wearing it under your wetsuit sleeve, or by using a protective cover (easy to make from scrap neoprene, or a section of old wetsuit sleeve, or even easier to buy from Aqua-Craft). If a bracelet or strap breaks, the watch won't be lost. Adding a flap over the crystal (secured with velcro) will help protect it against scratches.

Covering a wide range of styles, prices, movements, and features, the watches in this survey represent the culmination of centuries of development. As timepieces, they are an integral part of dive safety, and with proper care, should give years of satisfactory performance.

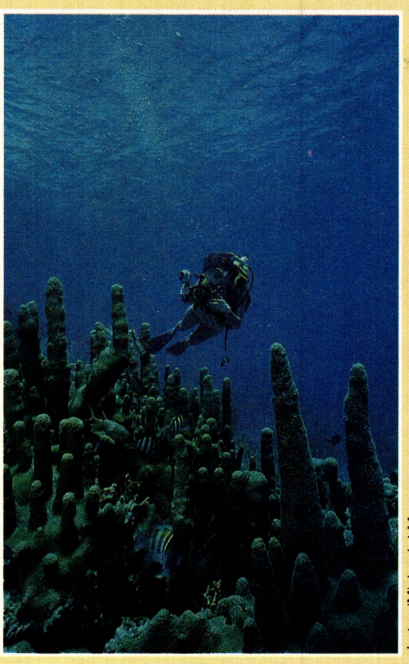
SDM travel SECTION

A Sail/Dive Vacation in the BVI

by Bonnie J Cardone



photo/Bonnie J. Cardone



photos/Michael J Morgan

A tropic isle lushly carpeted in green: blue skies overhead, warm, clear waters all around. Picture yourself diving all day: Finning through forests of staghorn coral, photographing colorful fish, exploring a famous wreck. At night you dine on fresh seafood prepared by a native chef, then stroll under star-filled skies. The air is fresh, the water pristine. All you lack is someone with whom to share these marvelous experiences. Well, if you've got a potential dive buddy in mind, the Moorings, on Tortola in the British Virgin Islands, has a program that just might interest you.

The Moorings is a charter yacht club established in 1967. It is one of the oldest and largest charter operations in the Caribbean. It has two facilities, one on Tortola and one on St. Lucia in the Windward Islands. The affable owners/managers of the Tortola facility are Ginny and Charlie Cary. Tony Rainold owns and manages the stateside operations in New Orleans.

Right in front of the Moorings' Mariner Inn is Underwater Safaris. This little dive shop is open and provides air fills every day from 8:00 am to 5:00 pm. It has scuba and snorkeling gear for sale and rent. Nikonos cameras may also be rented. A PADI training facility, U/W Safaris offers resort and basic scuba certifications as well as a unique service for yachtsmen. If you call the shop from the shore or your boat, U/W Safaris will send a boat and an instructor/guide to rendezvous with you at one of four islands. The instructor/guide will bring all of the scuba gear you need, pick you up at your boat, take you diving and deliver you back to your boat afterward.

Underwater Safaris also rents gear to those chartering one of the Moorings' Mariner 39's, Morgan 46's, Gulfstar 37's or 50's. You must show your C-card for all rentals and air fills.

Tortola is sparsely populated. The people are friendly. Theft is almost unknown. The islanders speak English but in a sing-song way that makes it difficult for most Americans to understand. However, these smiling people are always patient about repeating themselves until you catch on. Should you desire to visit Road Town, set out on foot along the road. The first person who happens by in any vehicle will stop and offer you a ride. No payment is expected or desired, you simply return the favor to those you encounter along the way should you ever happen to be driving.

On Tortola, the Moorings is across the bay from Road Town. The facilities consist of more than 80 rental yachts, a sundries store, a hotel and restaurant, a swimming pool and a tennis court. The Mariner Inn (the Moorings' hotel and restaurant) houses guests in two story bungalows, each with its own bathroom, balcony and wet bar. Thirty-six of the rooms are doubles and there are two, one bedroom suites.

Blue skies, with no hint of pollution, are overhead, and the warm, clear waters of the Caribbean are just a few steps away. If you have come here to go diving, you will. Every morning and afternoon one of Underwater Safaris' three dive boats leaves for one of the excellent dive spots a short distance from Road Town Harbour. These include the *Rhone,* one-half hour away and Blonde Rocks, about a 15 minute ride.

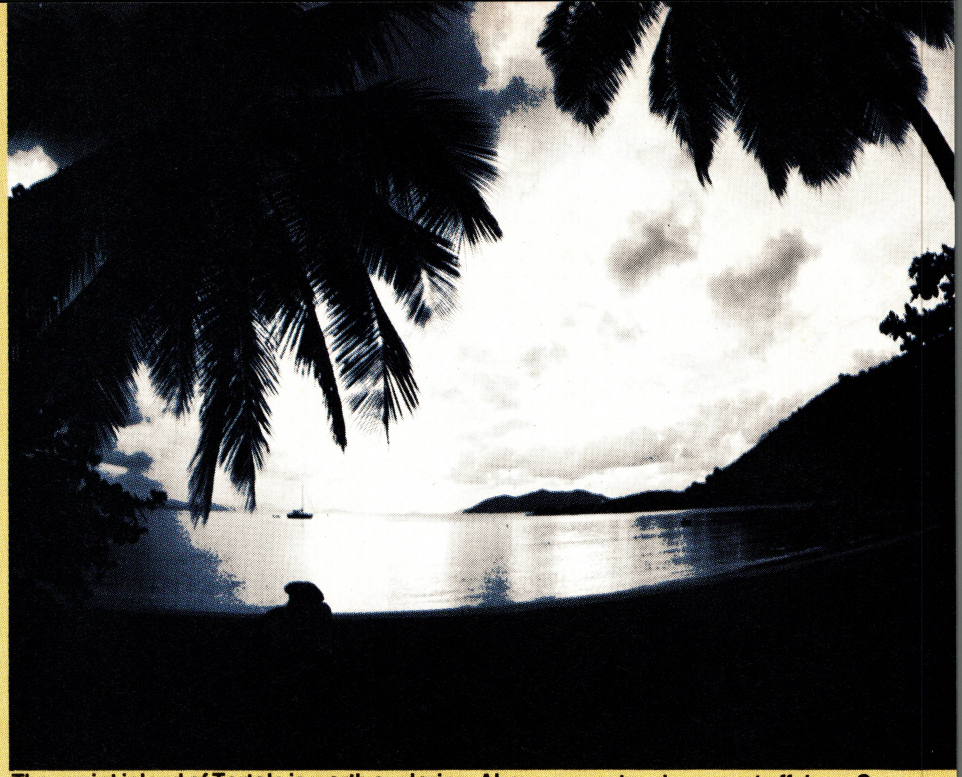
Now, about that dive buddy. Perhaps you have a good and dear friend who has always been interested in diving. However, he took one look at a surf-pounded beach and announced he was still feeling weak from the flu — he'd have to skip basic

scuba class (which starts on Monday). Or, perhaps your potential buddy works nights or weekends and can't attend a regular class.

Well, consider these facts. The surf is rarely up in the British Virgin Islands. The water is bathtub warm and clear. The surface may get a bit choppy out in the open, but you can almost always find a cove with calm water. This is tropical diving. There are sponges, corals, pretty fish, etc. in shallow water. And, Underwater Safaris offers a basic scuba course, condensed into four days, that results in full PADI certification. The class begins on the third Tuesday of every month and meets from 9:00 to 12:00 and 1:00 to 5:00 through Friday. Students learn in the Mariner Inn outdoor pool in the morning and practice in open water in the afternoon. They have a chance to experience the joys of scuba right away.

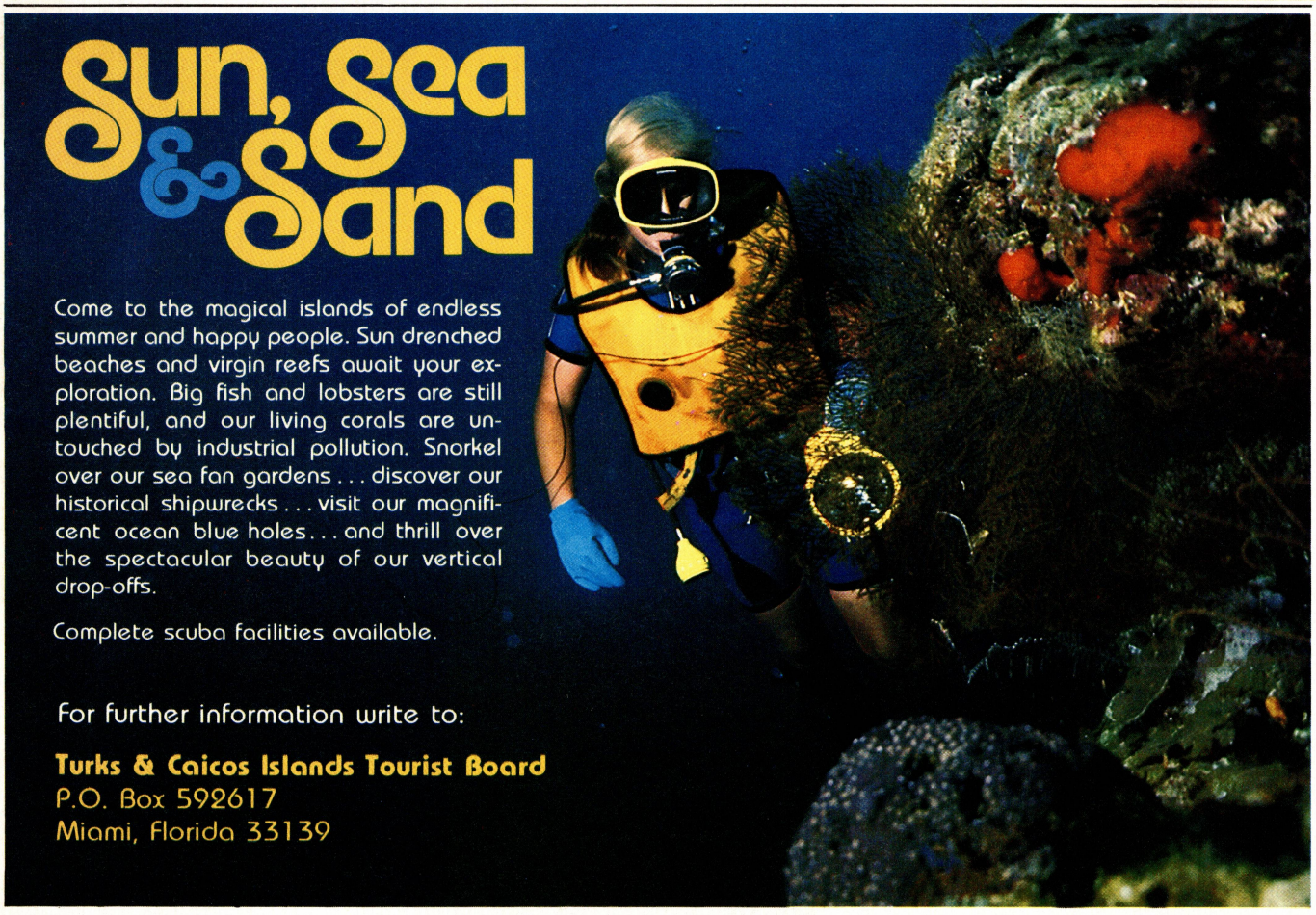
While your buddy is learning to dive, you can be out diving off another Underwater Safaris boat. At lunch and in the evening the two of you can share your experiences over an excellent meal prepared by the Mariner Inn. The dinner menu, mostly fresh seafood, is exceptional.

On Saturday the two of you can dive together, perhaps on the wreck of the *Rhone*.She is a beautiful old lady and her wreckage lies in depths from 20 feet on down to 80. She is covered with corals and colorful sponges. Underwater Safaris offers night dives and if you have a chance to make one on the *Rhone*, don't miss it. At night the *Tubastarea* corals "bloom" with bright orange polyps. The parrotfish sleep in the crevices and the resident barracuda is sluggish.

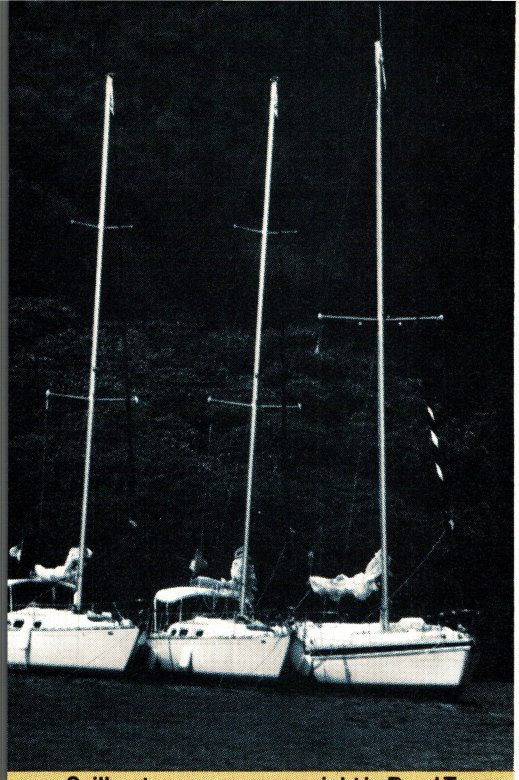


The quaint island of Tortola is worth exploring. Above, a spectacular sunset offshore Cane Garden Bay, on the northwest side of the island and just a hillside ride from Road Town.
photos/Bonnie J. Cardone

Tortola is easy to reach by air. Eastern has flights to San Juan, Puerto Rico or St. Thomas, U.S.V.I. from all major U.S. cities. We flew an L1011 Whisperjet from Los Angeles to San Juan, with an hour



circle #111 on Reader Service Card



Sailboats are a common sight in Road Town Harbour. Whether rental craft or visiting yachts, they provide photo opportunities.

Eastern Airlines flies to San Juan and St. Thomas from all major U.S. cities. Connecting flights reach Tortola in the B.V.I.
photo/courtesy Eastern Airlines

stopover in Miami. From San Juan we flew to Beef Island aboard a Dorado Wings six-seater single prop. Eastern and Dorado provide quite a contrast. Eastern's Whisperjet is comfortable in coach, luxurious in first class. The Dorado Wings plane has no flight attendants or beverage service. It flies low over the water (great for photography!) and the open windows provide a fresh breeze.

Beef Island is a small island off the eastern end of Tortola. The airport there is tiny. The Moorings dispatches a shuttle bus to meet arriving guests and the trip to the Mariner Inn takes about 20 minutes. The highlight of the trip is the Queen Elizabeth Toll Bridge, which connects Tortola and Beef Island. Despite its regal name, it is a narrow structure spanning what looks to be little more than a creek.

My trip to Tortola is but a warm memory now, to be relived with my new dive buddy through the wonders of color slide film. Interested? Contact the Moorings at P.O. Box 50059, New Orleans, Louisiana 70150; telephone (800) 535-7289 or (504) 834-0785. Have a good trip!

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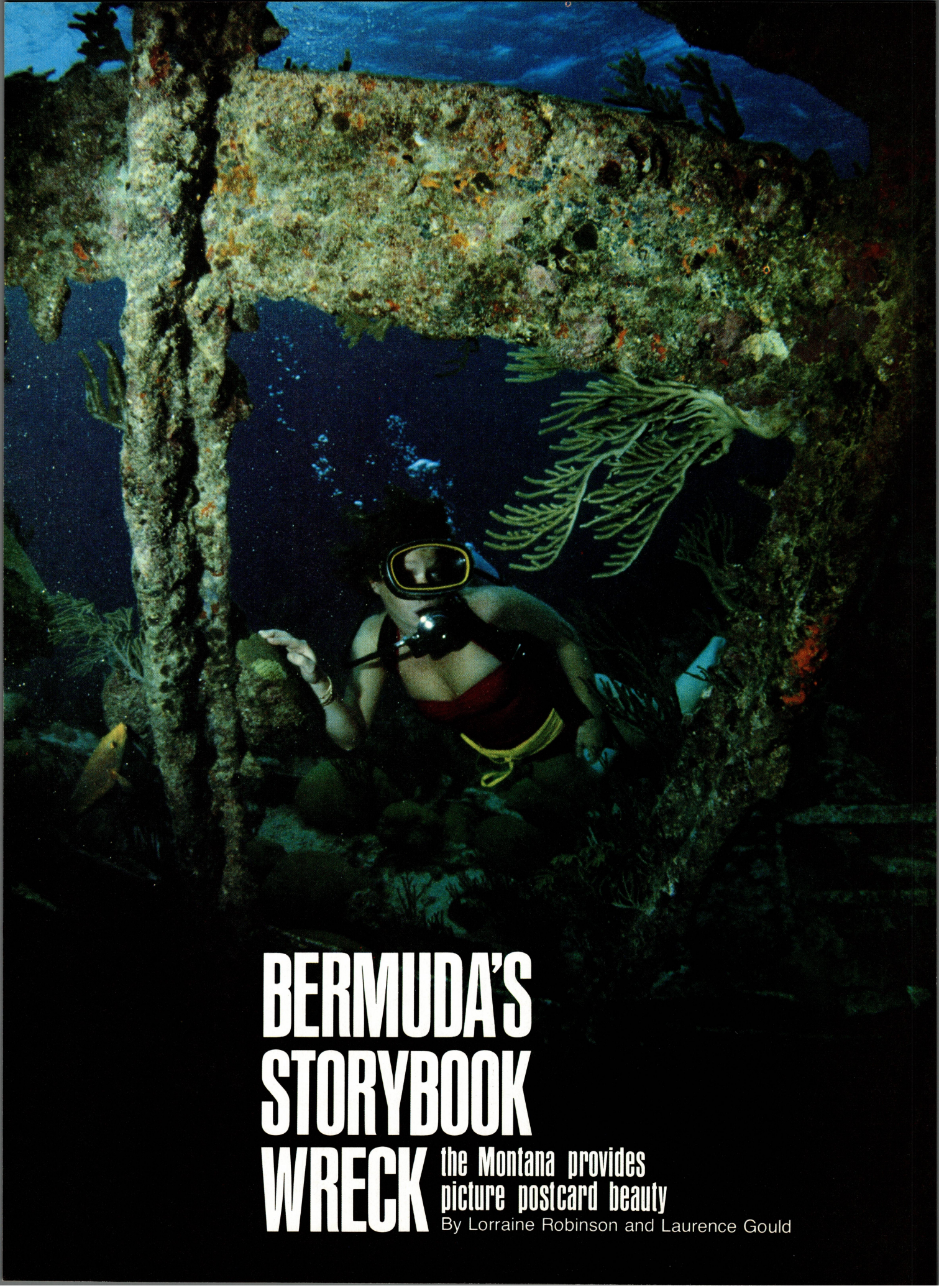


BERMUDA'S STORYBOOK WRECK

the Montana provides picture postcard beauty

By Lorraine Robinson and Laurence Gould

In the waters surrounding the island of Bermuda lie a tremendously large number of shipwrecks, ensnared on beautiful but treacherous coral reefs. Many of these have been flattened and badly broken up with the passage of time and the pounding surge of the Atlantic Ocean. There are some wrecks, however, that have withstood the battering of the sea remarkably well.

One of these resilient wrecks is a sidewheel paddleship (which sank some 118 years ago) known as the *Montana*. Built in England, she was used primarily as a blockade runner for the Confederate States during the American Civil War. Because of this she frequently changed her name to conceal her identity. Some of these names included *Nola, Gloria* and *Paramount*.

The usual route the blockade runners took was from England via the Bahamas or Bermuda, to the Confederate States. The cargo usually consisted of food supplies and guns. On arriving in the Bahamas it was transferred to fast, shallow-draft ships which had to run the gauntlet of the Union Navy.

The Confederates were not the only ones to benefit by this smuggling. The ships would exchange their cargo for cotton which would be taken to England to help alleviate the shortage there.

On her ultimate journey, the *Montana* was sailing from Glasgow to Nassau. During the passage she endured several hard gales which made it necessary for her to head for Bermuda to replenish her coal supply.

While heading into the island she was hit by yet another bad storm which drove her onto a reef in the Western Blue Cut area on December 30, 1863.

While she was stuck on the reef her cargo and engine were off-loaded to tugs and taken to the island where they were eventually auctioned. Several unsuccessful attempts were made to salvage her, but the *Montana* was abandoned seven days later and left to the mercy of the raging seas.

Today, the wreck of the *Montana* lies seven miles northwest of Bermuda. It is a popular dive site because of its close proximity to several other wrecks. One of these is the *Constellation*, which is a mere 100 foot swim away. This is perhaps Bermuda's most renown wreck because it inspired Peter Benchley's book *The Deep*.

It has been suggested that the *Montana* may have caused the sinking of the *Constellation* but there is no conclusive evidence of this.

The first thing that usually greets a diver visiting the *Montana* is a school of about 30 barracuda, that will follow you for quite a while before going off to watch something else.

The wreck is made of steel and was originally some 200 feet long. It lies on the bottom in three main parts. The bow section lies on its side in about 25 feet of water rising to within 8 feet of the surface. Because the basic shape of the superstructure has remained intact it is easy for divers to swim in and through this section. It is particularly good for photography and provides an excellent frame for diver shots. The outer sides of the bow are encrusted with sheets of fire coral which provide a home for masses of tiny Christmas tree and fan worms.

The mid-section of the ship consists of two large, square boilers that come within three feet of the surface. The severe outlines of the boilers' sides are now softened by the gorgonians and long purple searods that move gently with the current. At the top of the two boilers there is a large circular hole, just wide enough for a photographer to squeeze into to take silhouettes of divers ringed by soft corals. These two boilers attract a great number of smaller fish such as sergeant majors, blueheaded wrasse, cleaner fish and butterflyfish.

Another part of the mid-section, and perhaps the most important features of the wreck to a photographer, are the ship's two large paddlewheels. These lie by the sides of the boilers and measure about 25 feet in diameter.

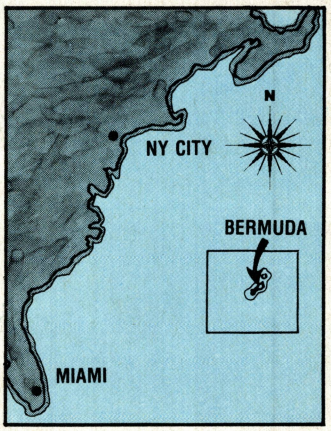
The other part of the mid-section is the funnel of the *Montana*. This lies over the edge of the reef in a sand hole, at about 30 feet. Because of its position, it is often overlooked by divers. There is a resident three foot long tiger grouper that lives inside the funnel.

Living in the caves on the sides of this sand hole is a group of about 15 large gray snappers that acts as an early warning system to the tiger grouper, usually giving it time to leave the funnel before a photographer can get near it.

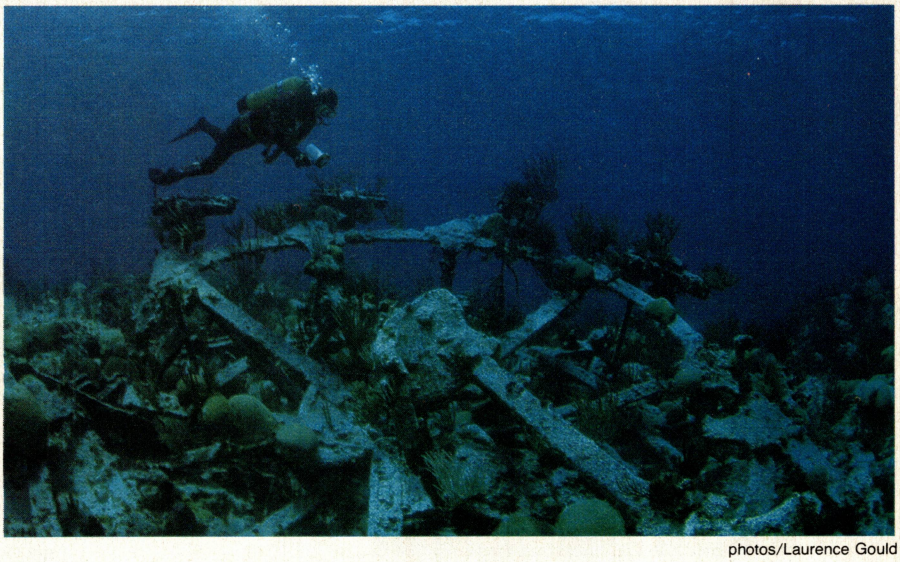
The third distinct section of the *Montana* is the stern and this is very overgrown by the soft and hard corals. All that remains of it is the very graceful curve of the superstructure, semi-circular in shape. This is in a sandy area, and there are always yellow goatfish busily sifting through the sand with their whiskers. It is only with great reluctance that they move off when a diver comes too close.

This is probably one of Bermuda's most photogenic wrecks: It is easily accessible both for the resident and tourist. Because it is situated on the edge of the deep, the water is continually moving, and the visibility is usually between 70 and 150 feet. Because it is shallow there is plenty of natural light.

Despite the popularity of this wreck, the reef life on and around it is in pristine condition. There are very large purple seafans that span as much as four feet. The smaller life in the area is diverse and while diving on and around the wreck I have found flamingo tongues (unusual in Bermuda's cooler water), arrowcrabs, nudibranchs and groups of squid. This wreck always provides the diver with an enjoyable dive and the photographer with a great wealth of material.



Opposite, a diver is framed in the bow of the *Montana*. Below, the huge paddle wheels of the *Montana* support a lush growth of corals and provide an exciting underwater setting.



photos/Laurence Gould

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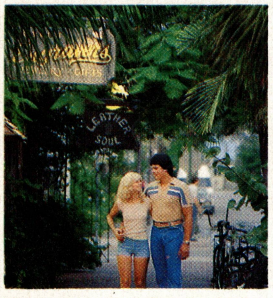


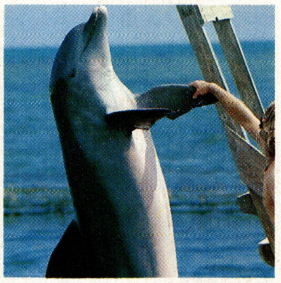

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CALIFORNIA'S CONCEPTION

California's newest and most diver-oriented boat is now operating out of Santa Barbara. The *Conception*, owned and skippered by Roy Hauser and Glen Fritzler, was launched in July. Seventy-five feet long and 25 feet wide, she carries up to 49 passengers.

Specially built for multi-day dive charters to California's Northern Channel Islands, she has luxuries designed to

keep divers happy and comfortable. Each spacious double or single bunk is enclosed with curtains for privacy and has a reading light that swivels; there is a room below decks with two hot showers as well as the two hot showers on the main deck. On the dive platform, hatches conceal built-in saltwater game tanks and you can clean and freeze your catch on board. There is plenty of storage space in the bunk room and a drying room below decks has hangers for wetsuits.

The two compressors fill four tanks at a time so you never need to wait for air. The spacious galley has all the newest kitchen equipment: Wet divers are welcome.

Between or after dives, use the top deck for sunning or watching the activities below.

The wheelhouse is equipped with the latest in navigational aids, including Loran C. A depth indicator there connects with one on the main deck so that the divers can always see how much water is under the boat.

Although the *Conception* runs mostly multi-day trips, as does Hauser's *Truth*, she has one-day open boat trips as well. For more information, pick up a *Truth/Conception* calendar at your dive store or phone: (805) 962-1127 or (805) 963-3564.

SEA & SEA CORRECTION

The Photo Gear section of October's SKIN DIVER featured the Sea & Sea Widelens 20 mm and an incorrect address. The correct address is: Sea & Sea USA, 439 Mola Ave., Ft. Lauderdale, FL 33301.

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Get It All TOGETHER before you leave

and you'll have a trouble free diving vacation

BY DEE SCARR

Finally! You're going on a dive vacation — and it's about time! But, you might be surprised at what can happen to your equipment before you get to those lovely reefs and clear waters. After working several years in the Caribbean, I've learned some lessons I'd like to share with you. I can't guarantee a perfect vacation, but by following these suggestions you can avoid some frustrating problems.

PREPARING

Avoid traveling with untested equipment — and leave enough time between the test and the trip for repairs, additional purchases, and testing again. A typical problem is that of the newly overhauled, free-flowing regulator. The adjustment is minor but annoying and much simpler to take care of before your trip. Likewise, shooting a test roll or two (or ten) with a new camera system while you're at home lets you learn how to use it and saves precious vacation time.

PACKING

Leave O-ring seals unsealed whenever possible. Although dive equipment is manufactured to withstand increased pressure, it is not built to deal with the decreased pressures of flight. Leave the dust cap out off your regulator to avoid pressure gauge problems. Underwater lights and photography gear should be carried unassembled if possible. If this is not feasible, remove the O-rings so the equipment isn't sealed. (To idiot-proof this precaution, place the O-rings in baggies and tape them to their respective cameras or lights — when you get ready to use the equipment you'll be sure to notice them.)

Pack your equipment with Murphy's Law (If something can go wrong, it will.) in mind, thinking especially in terms of breakage and loss. Thanks to the occasionally-earned reputation of airline baggage handlers, many divers now pack their scuba gear in suitcases, transferring it to gear bags at their destinations. You can also protect equipment by using your wetsuit to line your gear bag — it provides a cushion against rough handling.

TRAVELING

All too often divers arrive at their destinations only to discover that their baggage hasn't. Once you realize this, all sorts of preventive measures come to mind. Some of the options are:

(1) Purchase additional insurance on your baggage from the airline on which you're flying when traveling within U.S. boundaries. Your luggage will get special tags and special treatment; if it gets lost the insurance cushions the blow . . . Unfortunately, this service isn't available for international flights, but some travel agencies offer travel insurance on your possessions for the length of your trip. You lose the advantage of special treatment from the airlines, but gain theft insurance.

(2) Check your luggage only as far as your departure point from the U.S., then pick it up and check it in again at the counter of the international airline. This system results in fewer baggage transfers for the airlines and thus fewer opportunities for the baggage to be lost. If the bags are lost, the search is narrowed down to specific locations.

Once in awhile gear bags arrive safe and sound, and only later does the diver notice that some single piece of equipment — a mask, or a regulator, or a depth gauge — is missing. Apparently, "gremlins" occasionally slide open that gear bag zipper, slip out whatever piece of equipment is lying on top of the bag, close the zipper and send the bag on with no one the wiser. Locks can prevent this pilferage, but they won't last long around salt water. A better solution is to use the split rings from key chains: anyone can open the bag, but it takes some time, and time is what the gremlins don't have.

The ultimate method to prevent damage, loss, or theft is to carry essential equipment on board with you. The trick is determining just what is essential! A prescription mask would be high on anyone's list. Non-photographers might also carry a gauge console and even a favorite BC. Photographers usually carry their photo equipment. A good guideline to follow is: if you can rent a replacement easily, check it. If not, carry it.

There! Now you are not only ready to go diving, but you're likely to have everything you need when you jump into the water. Say hi to a fish for me!

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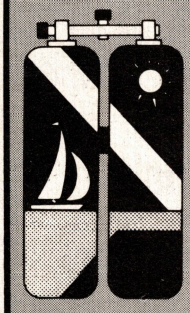

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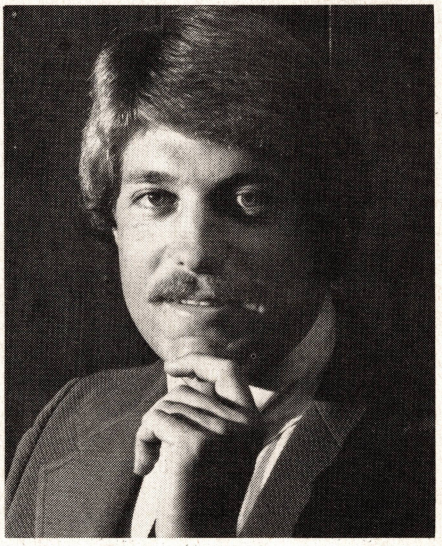

co-authored the *PADI Advanced Dive Manual* and conducted instructor seminars nation-wide.

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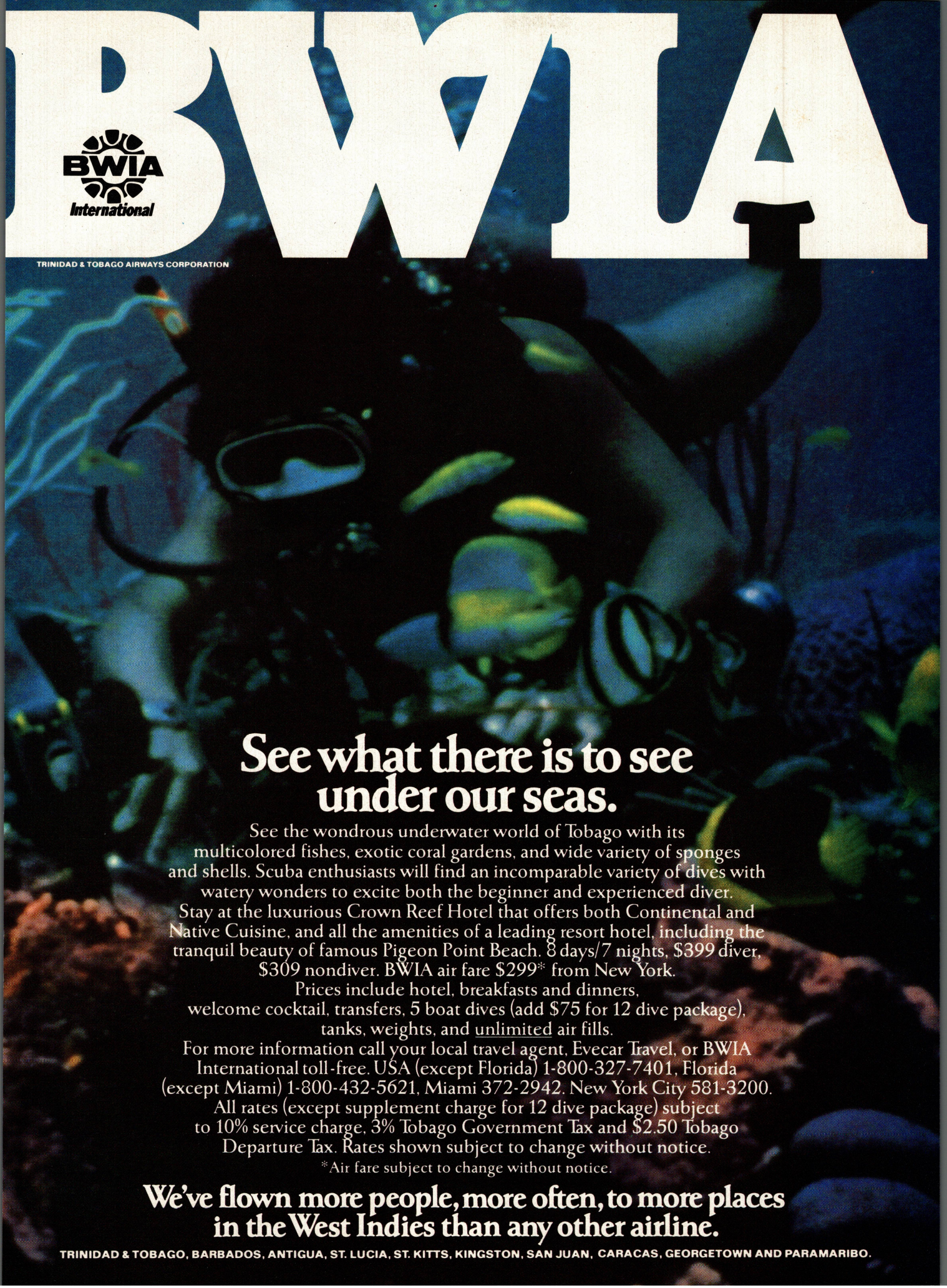
Recent additions to the Sunset House service are a high speed 32 foot Robertson custom designed dive boat, and a new oilless, air compressor. A new 22 foot craft, to carry smaller groups is currently being readied for use.



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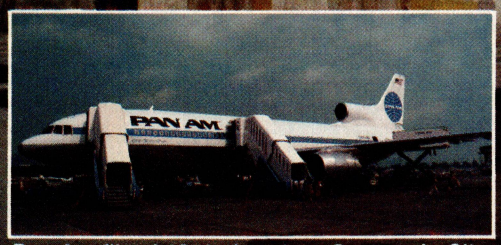
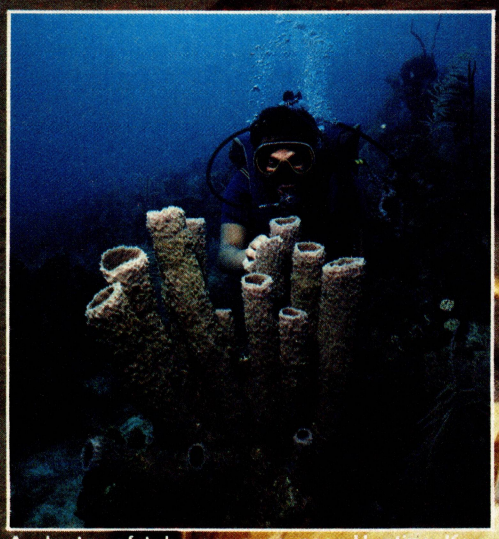


Pan Am flies L1011 aircraft to Guatemala City.



A cluster of tube sponges near Hunting Key.

Higher altitudes include many picturesque sights like this woman weaving near a church in the city of Antigua.

Guatemala

The highs and lows of Central American diving

Text and Photography by Marty Snyderman

Thoughts of Guatemala and the Central American jungle careened around in my head as I heard the captain of our Pan Am L1011 ask us to, "please raise your seat backs for landing" as we made our final approach into Guatemala City.

To be totally honest, I was traveling on rather short notice and didn't even know the trip's itinerary. Needless to say, I was a little leery, but the moment I met Senor Hector Sosa at the airport, that uneasiness was put behind me. He had a lively step and that certain air about himself that made me instantly realize I was in for a terrific week. Hector is the owner/operator of Acuarios Dive Store in Guatemala City. He was relaxed and obviously comfortable with the plans for the coming week.

Hector had me checked into the Guatemala Sheraton where we discussed the coming week's plans. He told me that we would, "enjoy two days of high altitude diving in the fresh water of Lake Atitlan. Then I'll take you to see Antigua, the second oldest city in the Western World. And after that we will be off to the *cayos* (keys) out of Puerto Barrios for three days of diving and camping Caribbean style." Hector then added, "Tonight it's a Guatemalan feast and the sights of the city."

Guatemala City is a modern, bustling metropolis. It is in fact much more modern than I had thought possible. The cultural mix of Indian descendants and European settlers yields a city of unique flavor. For entertainment you have a choice of almost anything from modern discos to shopping in open air markets. We tried both of those and a few more. As the night ended, I seemed to recall laughing a lot, clapping to the beat of traditional Indian music, and ordering one more beer at least two or three times because I wanted to stay up and listen to Hector's stories about diving the keys.

Diving Lake Atitlan was an unusual experience for me. The natural landscape around the lake is magnificent. I remember the scene. A beautiful lake surrounded by three towering volcanoes, one of which is still active. For the first time in years I didn't instantly recognize most of the life that I saw. Visibility was more than 40 feet on our first dive and we saw several large schools of medium-sized mojarra along the edges of boulder bluffs. Shimmering in the sunlight, these bass-like fish are a beautiful sight to see. They are, however, not easily approached by divers.

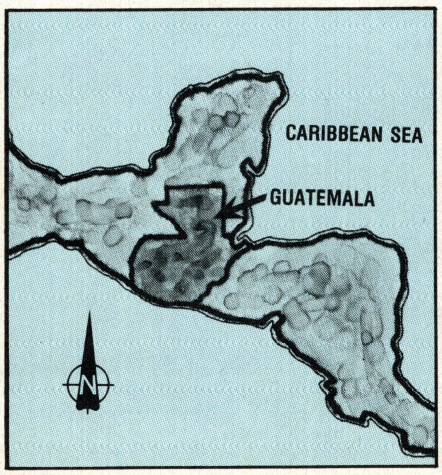
A local favorite for the gametakers are the numerous small crabs. They, too, are leery of divers but coming up with enough for *sopa de congrejo* (crab soup) is usually just a matter of being hungry enough. A half dozen of the small crustaceans will satisfy most groups.

From a geophysical standpoint, the lake is quite interesting. The drop-offs from shore are rather steep and it is quite easy to hit a depth of 100 feet before you are 50 yards from shore. At an altitude of just over 5100 feet one must use high altitude tables and capillary depth gauges. Visibility underwater often exceeds 40 feet.

The following day we were off to Antigua to sightsee in a town that retains an 18th century atmosphere. Cobblestone streets, ornate churches and ancient forts are the vestiges of what was once the most important city in Central America.

The next three days were spent enjoying the pleasures of the Caribbean. We camped and dived in the Cayos del Zapatillo, a group of small sandy cays about three hours by boat out of Puerto Barrios. White sandy beaches, palm trees, warm clear water, the sounds of sea birds and waves lapping on the beach were the order of the day. Isolated and peaceful, the setting is perfect for dive adventures. The area is virtually uninhabited, visited only by local fishermen who want to take advantage of the freshwater wells. The reefs remain as beautiful as ever, relatively free of the intrusions of industrialized man.

Only a few minutes after our arrival, Alvaro and I were in the water. Sand channels cut through coral reef provided magnificent backgrounds as I went to work with my camera. I was hoping just to shoot a roll of macro subjects and get a feel for the water as I settled on the bottom looking for tubeworms and small reef fish. They were everywhere — featherdusters, Christmas tree worms, butterflyfish, lizardfish, angelfish, coneys, the works! I was in only 25 feet of water and planning to take my time, but as I settled on the bottom I found myself surrounded by a school of tarpon. Cruising curiously at first, they soon began to dart in one direction and then another as they swirled about us. Tarpon are regarded as a highly-prized, medium-sized game fish rarely seen by divers. They are capable of impressive bursts of speed, are easily excited and are beautiful to see as their highly reflective silver scales sparkle in the rays of sunlight. In a matter of seconds they appeared, closed to within five to ten feet, and vanished. I wanted to get back to featherdusters and the like, but I found that I kept glancing up, hoping for one more look at those speedy tarpon.



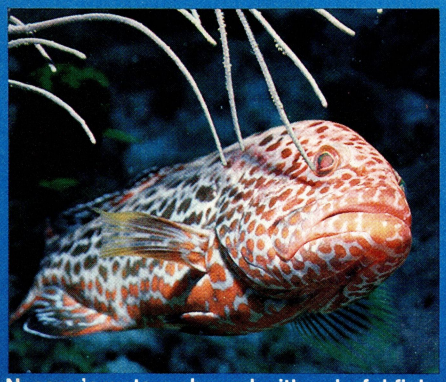
At Hunting Key, Seal Key, and Ranguana the vertical drop-offs begin only a few yards offshore. Clear water and beautiful coral formations provide the background for the variety of sponges that cover the walls which begin in only 20 feet of water. By the time Alvaro and I had reached 60 feet at Seal Key we had seen tube sponges, lacey vase sponges, rope sponges and basket sponges. They were, of course, covered with bright yellow crinoids and pink brittle stars. Obviously you would think that "sponges along the walls" would have been the agenda for me, a photographer, but in the distance I spotted Hector riding a turtle. Off I went at break-neck speed, or at least leg cramp speed, but the turtle dumped Hector before I could close to within camera range. I chided Hector through my regulator, but he looked at me as if to say, "No big deal, we do it here all the time."

The rest of our time in the keys was spent filming small reef life from jackknifefish to conch. The variety of sea creatures in these waters seemed almost endless. The water is obviously healthy, as evidenced by the quantity and variety of marine life. The coral formations were rather impressive and the variety of corals provided excellent photographic material. Better yet, the good diving begins in only a few feet of water, so bottom time is not a concern unless you choose to go over the wall.

Walking alone along the beach at sunset after our last day of diving I thought back over the past few days. I wondered what my next trip would be like. I knew that one of the best things about Hector's trips is his ability to customize them for the desires of his clients. He can include or exclude Lake Atitlan, Antigua, Tikal and other side trips. He can provide a beautifully equipped boat with no camping, or you can sleep and eat on the beach.

For further information contact: Hector Sosa, Acuarios Dive Store, 20 calle 3-94, Zona 10, Cuidad de Guatemala, Guatemala, Centroamerica; telephone 680137.

NASSAU'S SOUTH OCEAN BEACH



Nassau's waters abound with colorful fish.

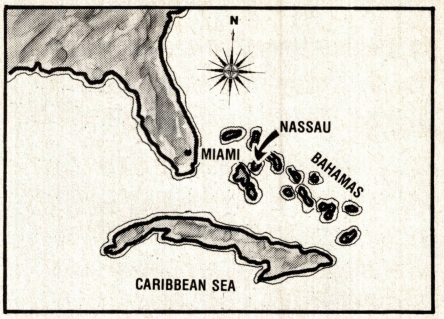
A large spider crab brandishes its claws.

Courtyard of the South Ocean Beach Hotel.

Below, Melanie Vincz glides over a cluster of magnificent purple tube sponges.

A BAHAMAS SURPRISE

BY CHARLES GORDON



Somewhere in the history of dive vacationing, the idea took root that to find the best diving, you had to travel to the most remote places. Well, while it is certainly true that some of the world's most exciting dives are found in hard-to-reach places, it has also become patently obvious that some are not. Nowhere is this clearer than at Nassau's famed South Ocean Beach Hotel.

Located only a few miles outside the exciting hustle and bustle of historic Nassau, with its world-famous casinos, South Ocean Beach is a manicured, private resort offering the best of both worlds to vacation-seekers. The hotel amenities are first-class, all in air-conditioned comfort. The dining, whether in the European restaurant or at the sumptuous island-style patio buffets, is superb. The Cap'n Lorenzo and his Crew Sector Four band entertains nightly; not your typical "Rake and Scrape" band by any means, these talented performers could appear equally well in the nightclubs of Los Angeles, New York or Miami.

For the sports-minded, there are tennis courts and the Bahamas' only PGA golf course. (The course's two blue holes may be the ultimate in water hazards!) On the beach, the watersports operation offers not only wind surfing and sailing, but also one of the most comfortable and unique dive programs to be found anywhere.

Co-owned and operated by experienced PADI instructor, Grover Moberly, and his lovely wife, Denise, the dive operation is presented in a fashion consistent with the rest of the hotel's offerings. Standard gear consists of aluminum tanks, regulators (with octopuses), pressure gauges and jacket BC's. The dive boat is a new, custom built 43 foot craft; carpets, spacious interior, stereo music, radio and full emergency gear make it one of the most comfortable vessels a diver will ever find.

But wait, there is more. The final touches are mixed in to make the dive program truly exceptional. The Bahamas dive manager, PADI instructor Rudy Turnquest, with Steve and Mike, his divemasters, provide service designed to make even the most hard-core, four dive-a-day diver sit back and enjoy. Once a guest has put his/her dive gear on the boat, it is unnecessary to carry it again until he/she leaves to head homeward. Not only can divers have their equipment assembled and brought up to the swim-step for each dive, everything is also washed and stored securely at the end of each day. Add the short (usually only 15-20 minutes) rides to most dive sites, and you have comfort and relaxation to the extreme.

But what about the diving? Nassau is not noted for its diving, you say? That, indeed, is one of the world's real secrets. Located on the Bahama's 4000 meter deep Tongue of the Ocean, New Providence Island's walls and reefs are washed by the same currents which nurture the famous Andros drop-off. In fact, South Ocean Beach's wall (which starts in less than 45 feet of water), is equal to the best walls found anywhere in the Bahamas.

Let's take a glimpse at some of the most popular spots:

Clifton Wall — Just 15 minutes from the hotel, this site is a classic. Starting in only 35 feet of water, the coral encrusted drop-off falls away suddenly to the depths. For photographers, huge purple tube sponges are prevalent and large lobsters can be seen at any hour of the day. Large amberjacks and other pelagic fish often sweep by the diver. In the late spring, clouds of large schooling mutton snapper can be seen milling about by the hundreds.

For a second shallow dive, the reef flats shoreward of Clifton Wall are varied and interesting. A changing terrain of tumbled corals interspersed with sand flats provides an excellent diversity of marine life. Most any dive will reveal Nassau and black groupers, lobsters, large rays and many different tropicals. Visibilities from the wall inward are in excess of 125 feet.

Rudy's Reef — A favorite spot just eight minutes from the hotel, Rudy's begins in 35 feet of water. The top of the reef is garden-like, with many gorgonians and seafans among hard corals. The wall itself pitches away dramatically, and African pompano, eagle rays and large mantas are seen regularly. The crystal-clear water enhances the finding of 17th century bottles here, many of which have been found by lucky visiting divers.

Tunnel Wall — Twenty minutes from South Ocean Beach, Tunnel Wall is unusual for the Bahamas. With its rugged crevices, honeycomb tunnels and sheer faces, it is much more reminiscent of Cozumel or Cayman. Dropping from 30 feet to nearly 6000 feet, this spot features more big fish than most Bahamian dive sites. Atlantic spadefish, huge swarms of chub and mutton snapper, large jacks and barracuda make this an exciting area. The top of the wall is an interesting contrast, with the muted purple tones of seafans and seawhips dominating the rolling bottom.

Goulding Cay — For a very different sort of shallow dive and for excellent photography, divers can be taken to Goulding Cay, off the western tip of New Providence Island. The dive boat carefully maneuvers to anchor in a natural, circular pool, 20 to 30 feet deep, fringed by huge stands of elkhorn coral. The dazzling, white sand bottom is the home of flounder, rays and schooling grunts. A huge group of squid frequents the shallow depression and divers can sometimes witness the unusual sight of their mass mating.

With other popular spots such as Porpoise Wall, Andros Landing, Mike's Reef, For Your Eyes Only and Thunderball (both film sites for James Bond movies), well-traveled divers rank South Ocean's diving with the best of the Bahamas. So, the next time you are planning a little tropical refreshment, mix yourself up a Bahamas Surprise. If you are like most people, you will find it a favorite!

For more information contact the South Ocean Beach Hotel: U.S. Sales Office, 9300 S. Dadeland Blvd., Miami, FL 33156, phone (305) 666-7136; or Omorka Tours, P.O. Box 76721, Atlanta, Georgia 30328, phone (800) 241-7977.

photos/Al Hornsby

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KEY LARGO STORE MOVES

Quiescence Diving Services of Key Largo, FL has moved its retail store, classroom facilities and charter boats to an on-water location on the main highway: MM #103.5, Key Largo (formerly Key Largo Diving Headquarters).

For more information call (305) 451-2440 or write P.O. Box N-13, Key Largo, FL 33037.

INSTRUCTOR WANTED

The Winding Bay Beach Resort of Eleuthera, Bahamas is looking for a divemaster or dive instructor. The job requirements include: organizing scuba-snorkeling and sunfish sailboat lessons and trips, deep sea fishing, reef fishing and bonefishing trips; organizing skiing and skiing lessons, rental of sunfish sailboats, bicycles, snorkeling gear, organizing shell beach trips and beach parties; maintenance and care of all dive equipment, boats and motors; teaching resort courses and the Bahamian staff.

Any interested applicants requiring additional information should contact: Hubert Lewis, Winding Bay Beach Resort, P.O. Box 93, Rock Sound, Eleuthera, Bahamas.

COZUMEL CERTIFICATION COURSES

See & Sea Travel is offering dive certification courses for 1982. These one-week programs provide a full PADI open water certification, plus diving at world-famous Palancar Reef. Doug Nidros of Ukiah Skin & Scuba is See & Sea's host for these exciting new programs. The 1982 dates are: January 16-23, July 10-17 and November 13-20.

For further information, contact See & Sea Travel, Inc., 680 Beach Street, Suite #340, San Francisco, CA 94115.

REEF ROVER II TO COZUMEL

Hurricane Aqua-Center, Inc., of Marathon, FL is sending the dive boat, *Reef Rover II*, to Cozumel from December, 1981 through mid-April 1982. Multiple-day, overnight, live-aboard excursions will be offered along the reefs of Cozumel; to explore the Mayan ruins of Tulum; along the 70 miles of reefs to Cancun; and back to Cozumel.

The all-aluminum *Reef Rover II* will have, in addition to a 19 cfm 5000 psi compressor and restaurant-equipped galley, a forward scanning sonar for modern wreck and reef detection in these uncharted waters, as well as color radar and long range radios. To complement the 13 double bunks inside the cabin of the *Reef Rover*, mattresses, pillows and bed linens will be provided for sleeping on the roof under the stars. Alu-

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minum tanks and weightbelts are free for all dives (usually three per day), and there are about 20 sets of regulators, gauges, BC's, and some wetsuits available for rental.

For information contact: Hurricane Aqua-Center, Inc., 4650 Overseas Hwy, Marathon, FL 33050.

SCUBA MEDICINE COURSE

The next course on the Medicine of Sport Scuba Diving will be held February 6-13, 1982, on Bonaire. The emphasis will be on medical preparedness for diving emergencies.

The academic program has been approved by the AMA for 25 Category I credits, by the American College of Emergency Physicians for 25 Category I ACEP credits, and by the American Academy of Family Physicians for 25 Prescribed hours.

To be held at the Flamingo Beach Hotel, the course will include a complete dive program.

For brochure and information, please contact: Medical Seminars, Inc., 11406 Whisper Moss, San Antonio, TX 78230: telephone (512) 492-5656.

VACATION WINNER

Jim Moreau of Houston, Texas won a deluxe dive vacation in a drawing held at the Seaspace '81 divers convention, July 25-26. Jim's prize, an eight day/seven night, land/sea dive package, was donated by the St. Thomas Diving Club.

DIVE SITE INFORMATION NEEDED

A book covering popular and out-of-the-way dive spots in each of the 50 United States is being produced. The author is asking interested persons and dive shops to submit information. Any dive shop submitting information on three or more dive spots in its area will receive a free listing at the end of the appropriate chapter.

Those with information for this book or dive shops wishing to take out an ad in it should contact: Sven Stau, Dive Spots U.S.A., Box 1135, Buffalo, NY 14211.

SUNSEEKER HOLIDAYS/ S.S. VERACRUZ

Sunseeker Holidays, in conjunction with the luxury cruise liner, *S.S. Veracruz*, is offering a prepaid, 7 day, 7 dive cruise to the Mexican Caribbean. Ports-of-call will include Veracruz, Cancun (Puerto Morelos), Cozumel and Key West.

The cost of this tremendous package is $699 per person, double occupancy. Non-divers can deduct $154. Special rates are available for families with children under 12.

For further information contact: Sunseeker Holidays, 2609 Glendola Rd., Wall, NJ 07719; telephone (201) 681-2810 or NY (212) 265-6088.

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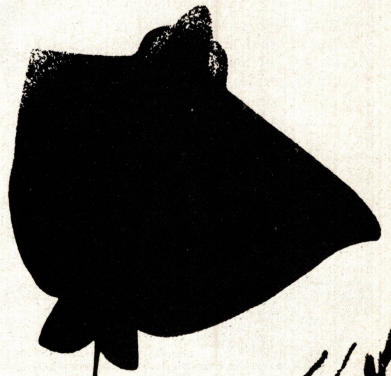

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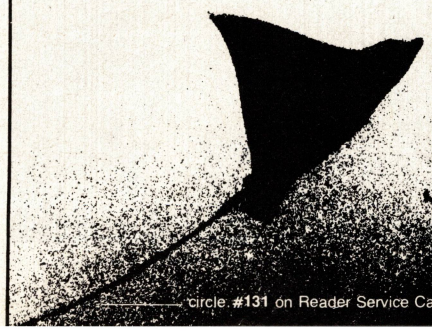

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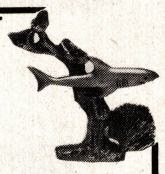
Sea Stuff

By Diving Artist Les Hunter



Diver—4½" long, on stand, very detailed, $10.00. Shark on coral—4"x4", $8.00. Both in handcrafted pewter.

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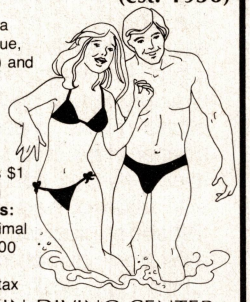

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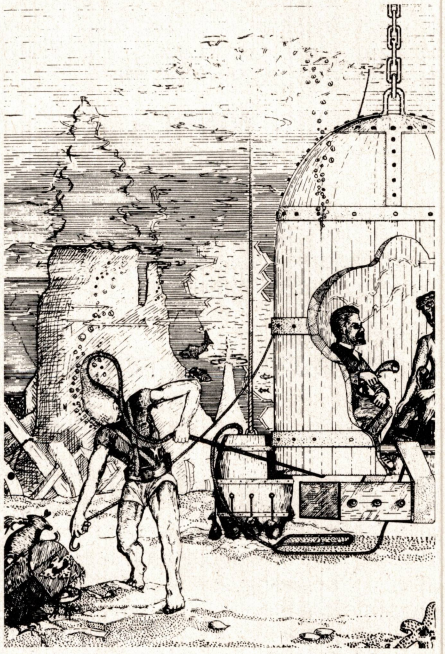
EVOLUTION

(Continued from Page 26)

that ran to the surface. Hopefully, no one ever tried to actually use this gem.

Within a few years, however, a new device appeared which had more potential for success. This device was the diving bell, and could not only extend depth, but increase bottom times from a few minutes to more than an hour. The first reference to a practical diving bell appeared in 1531. The early designs were essentially large wooden tubs, heavily weighted to compensate for buoyancy, and lowered from a ship into the water in an inverted position, trapping and compressing the air inside as it descended to the bottom. Divers could stay inside and work (if the bell were positioned properly), or make short, breath-hold trips outside, returning to the bell for air.



Wanting to improve this system, various methods were devised of resupplying fresh air to diving bells. In one, weighted barrels were lowered to the bell and the air transferred.

In the early part of the 18th century, some divers were moving away from the diving bell and into one-man, enclosed diving chambers. One innovative design was produced by an Englishman named John Lethbridge, in 1715. His chamber, or diving dress, consisted of a long barrel covered with leather and fitted with a glass viewing port, and watertight sleeves attached to arm holes (so he could extend his hands and arms outside to do useful work). Maximum operating depth was about 72 feet, where he could stay for about 34 minutes. The single man chambers were

(Continued on Page 92)

Photo: Bret Gilliam, V.I. Divers, Ltd.

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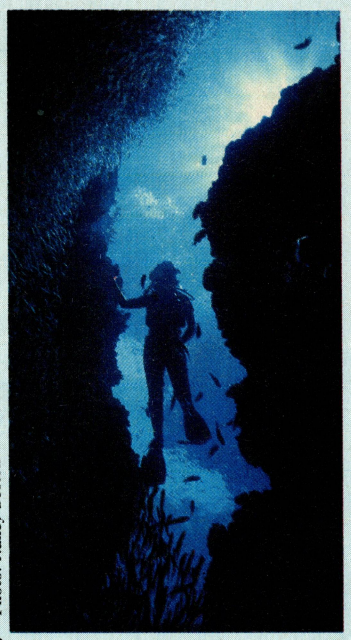

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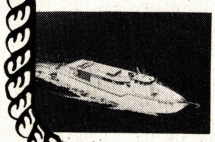

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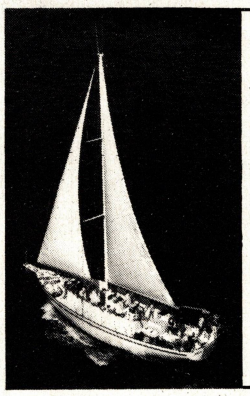

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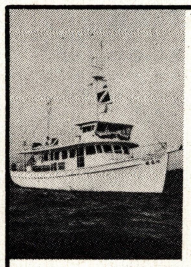

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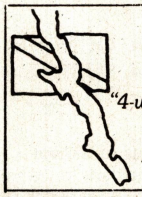

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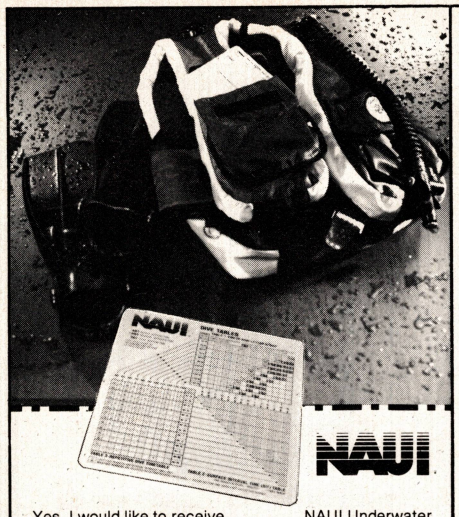

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Allan Klopp, president of STMM, kneels beside artifacts recovered from the *Admiral*.

searching for only three and one-half hours in the area where the *Admiral* was believed to have gone down.

The *Admiral* sank during heavy weather in the early morning of December 2, 1942 while pulling the oil barge, *Cleveco*, from Toledo to Cleveland. The *Cleveco*, loaded with one million gallons of crude oil, sank several hours later and was recovered in 1970. The loss of 32 lives on the two ships still represents the highest Great Lakes death toll.

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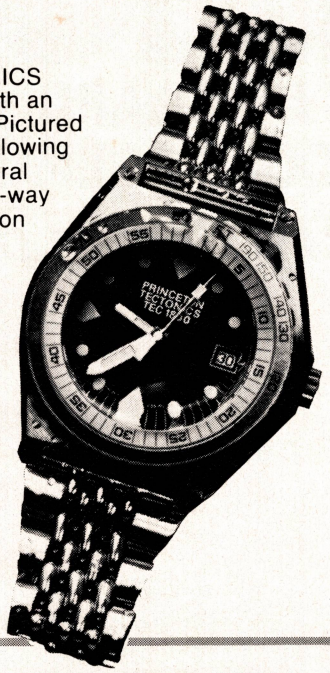

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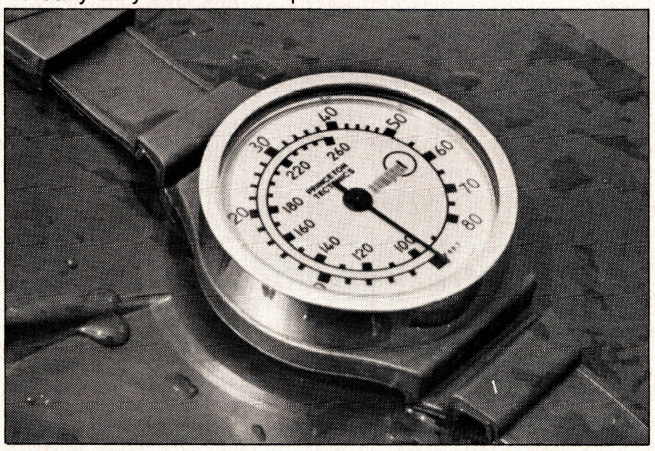

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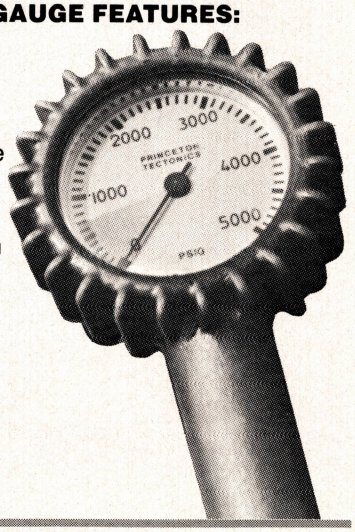

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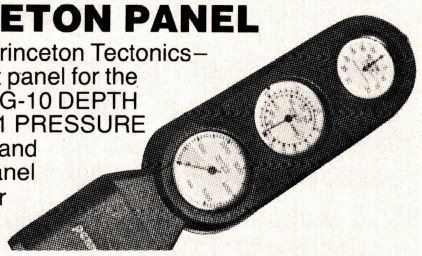

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Scuba Quiz

Category: Ear Equalization

By Dennis Graver

Problems with pressure equalization in the ears probably plague divers more than any other physical difficulty. Additionally, permanent damage to the ears can result if the effects of pressure are not handled properly. I believe knowledge and skill in ear equalization are among the most important items in diver education. Find out what you know about ears and their equalization with this quiz. The answers are on the following page.

NOTE: Select all correct answers: Several questions have more than one correct response.

1. Equalization of pressure in the ears should be initiated:
- ☐ A. Prior to beginning a descent
- ☐ B. At the beginning of a descent
- ☐ C. Before reaching a depth of ten feet
- ☐ D. When pressure is felt in the ears
- ☐ E. When pain is felt in the ears

2. It is easiest to equalize pressure during a descent when the position of your body is:
- ☐ A. Vertical with the head up
- ☐ B. Vertical with the head down
- ☐ C. Horizontal
- ☐ D. At 45° with the head up
- ☐ E. At 45° with the head down

3. Select the method(s) of equalization that will not cause the eustachian tubes to open:
- ☐ A. Attempting to blow against closed mouth and nose
- ☐ B. Swallowing
- ☐ C. Valsalva maneuver with head tilted sharply to one side
- ☐ D. Wiggling jaw back and forth
- ☐ E. All of the above methods will open the eustachian tubes

4. Equalization of pressure in the outer ear will be affected by:
- ☐ A. A cold
- ☐ B. Ear plugs
- ☐ C. An ear infection
- ☐ D. A tight fitting hood
- ☐ E. Plugged eustachian tubes

5. If descending and having difficulty in equalizing pressure in the ears, you should:
- ☐ A. Ascend to the surface and reinitiate the descent
- ☐ B. Ascend three feet and attempt equalization
- ☐ C. Ascend until pressure effects are relieved and equalize pressure
- ☐ D. Stop and wait until the pain subsides
- ☐ E. Continue to the bottom and equalize the pressure

6. Attempting a Valsalva maneuver with excessive force can result in:
- ☐ A. A ruptured eardrum
- ☐ B. A ruptured round window in the middle ear
- ☐ C. Permanent tinnitus (ringing in the ear)
- ☐ D. A reduction in hearing ability
- ☐ E. An improved ability to equalize pressure

7. Which of the following practices are not advised:
- ☐ A. Diving with a cold
- ☐ B. Head-first descents
- ☐ C. Use of decongestants
- ☐ D. Diving after major dental work
- ☐ E. Frenzel maneuver for equalization

8. Which of the following statements regarding the ears and equalization are true?
- ☐ A. The eustachian tubes are closed about 85 percent of the time
- ☐ B. Air in the middle ear is absorbed into the bloodstream
- ☐ C. Vertigo always results when an eardrum ruptures underwater
- ☐ D. When pain is felt in the ears during descent, pressure is actually holding the eustachian tubes closed
- ☐ E. Adolescents have more equalization problems than adults

9. Failure of pressure to equalize in an ear during ascent:
- ☐ A. Will result in pain and possible injury
- ☐ B. Can result in vertigo if the pressure is suddenly released
- ☐ C. May be relieved by inhaling against closed nose and mouth
- ☐ D. May be relieved by redescending and gradually reascending
- ☐ E. Is quite common among recreational divers

10. A person whose ear has been perforated:
- ☐ A. Should not dive even after the injury has healed
- ☐ B. May experience vertigo if the perforation occurs underwater
- ☐ C. May dive by using special equipment to exclude water from the ears
- ☐ D. May dive only if ear plugs are worn
- ☐ E. None of the above answers are correct

Scuba Quiz

Answers: Ear Equalization

1. B. It is important to keep ahead of ambient pressure increases when clearing the ears. If the outside pressure exceeds that within the ears, the pressure difference will actually hold the eustachian tubes closed, making equalization difficult or impossible. This effect, known as the trap door effect, can be prevented by equalizing early and often. Response D is correct, but choice B is the most correct. Answer A also has merit. I prefer to "pump up" my ears gently prior to initiating a descent.

2. A. We may be weightless underwater, but we are still affected by gravity, which causes blood to rush to the head if inverted. The blood then engorges the capillaries surrounding airways and decreases airway diameter, reducing equalizing ability. A feet-first descent allows better orientation and buddy contact and also helps prevent the swallowing of air. Disorientation can occur during a 45° head-down descent due to the positioning of the semi-circular canals in the inner ear. Descend with feet down and the head up.

3. All of the answers are correct. Perhaps the best known method of equalization is the Valsalva maneuver (described in answer A), but this is a forceful maneuver that can cause damage if overdone. Swallowing and jaw wiggling are less forceful and work well for some divers. Tilting the head to the shoulder opposite an ear that won't clear while attempting equalization can help in opening the eustachian tube. Perhaps the best method of all is known as the Frenzel maneuver, which involves thrusting the jaw and tongue forward with the throat closed.

4. B and D. Pressure will cause no problems in the ear canal unless the canal is closed off, as with ear plugs or a tightly fitting hood that allows no water to enter the ear. In these instances, there is no means to allow pressure in the ear canal to increase and become equal to an increase in ambient pressure. Although the middle ear space may equalize, the outer ear cannot and the eardrum will bulge outward and even rupture. Keep the outer ear open and clear.

5. C. As explained in the answer to question one, the trap door effect actually prohibits equalization. The pressure must be reduced before the eustachian tubes can be opened and the ears cleared. Pain is a signal that you must ascend somewhat before equalization will be possible. Continuing a descent after pain occurs will only result in tissue damage and may cause the eardrum to rupture.

6. A, B, C, and D. Yes, the eardrum can actually be ruptured outward by blowing too hard. And, although the process is physiologically complex to explain, the round window to the inner ear can also be ruptured by an overly forceful Valsalva maneuver. Needless to say, these injuries can permanently damage the ears. Don't blow hard against closed nose and mouth. Firm, but gentle, is a good policy when using the Valsalva technique.

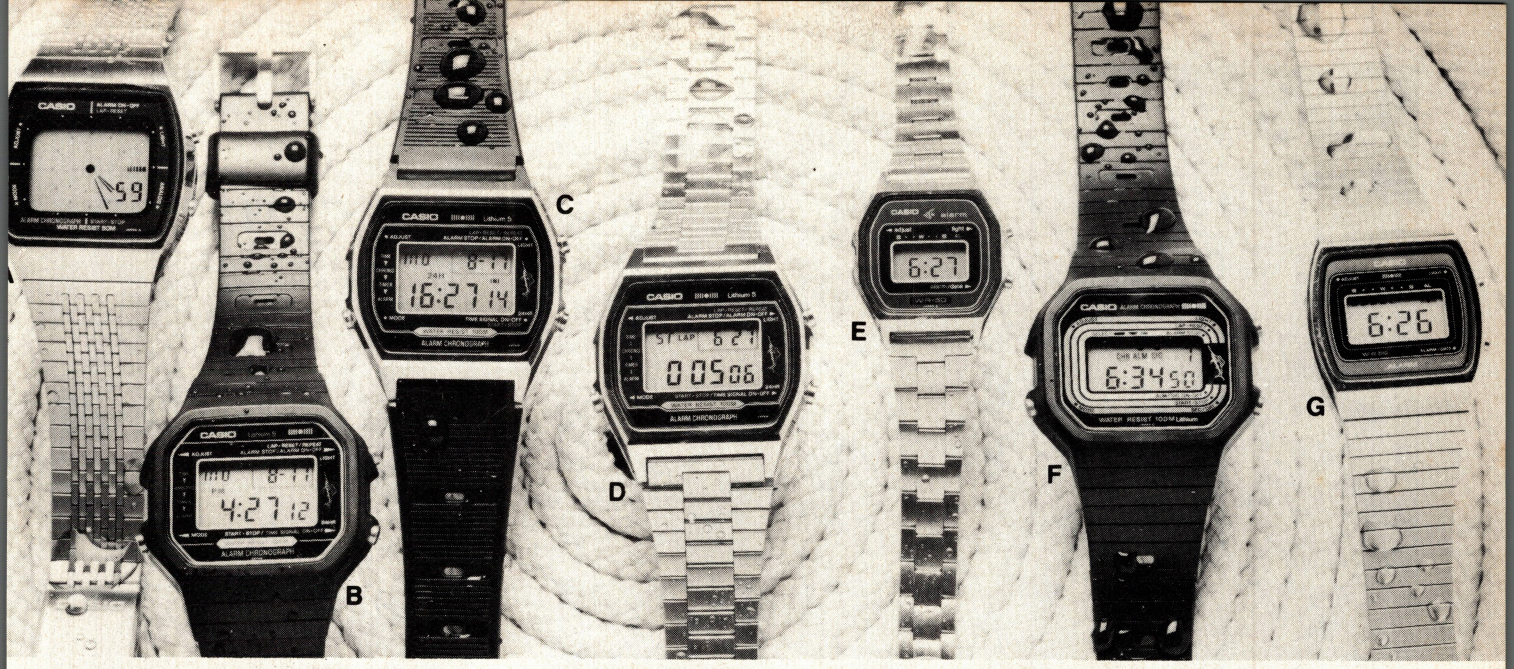
7. A, B, C, and D. Head first descents and colds both reduce airway volumes. The use of some decongestants may be permissible, but must be used with caution and advice. Dental work, especially when involved with top molars, can affect sinus cavities when it comes to equalization. As pointed out in answer three, the Frenzel maneuver is effective, but less likely to cause injury than the Valsalva maneuver.

8. A, B, C, D, and E. Yes, air in the ears is actually absorbed into the bloodstream and must be replaced periodically. It is because the eustachian tubes are normally closed that all of the various methods have been devised to get them to open and allow pressure equalization. Kids may have a difficult time with ear clearing, but the ability usually improves as they mature.

9. A, B, C, and D. Pressure in the ears needs to equalize during ascents as well as during descents. A reverse Valsalva maneuver may help reduce pressure during a reverse block of an ear. If the build-up of pressure releases suddenly, vertigo will occur. This dizziness, known as alternobaric vertigo, passes quickly, but should be avoided by slowing or stopping a descent if a pressure build-up is felt in the ear. Ear equalization problems during ascent are uncommon because it is much easier for air to get out through the eustachian tubes than it was for the air to get into the middle ears.

10. B. A perforation of the eardrum is a temporary, not a permanent problem. It can be serious because of possible infection, but it certainly needn't end a dive career once healed. See a physician. Vertigo from a rupture occurs if cold water enters the middle ear, but does not always accompany a rupture underwater. Special equipment is available that will allow a person with a permanently perforated eardrum to dive, but should not be used to compensate for a recent rupture. Of course, ear plugs should never be worn when diving.

If just one diver can equalize pressure more easily or prevent an ear injury as a result of the information contained in this quiz, it will have served its purpose. If you are a certified diver, you should have answered at least seven of the questions correctly. A lower score indicates a need to increase your knowledge and the ability to equalize pressure safely and comfortably.



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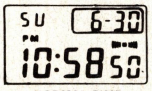

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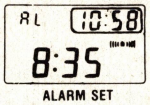

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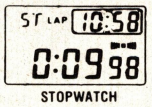

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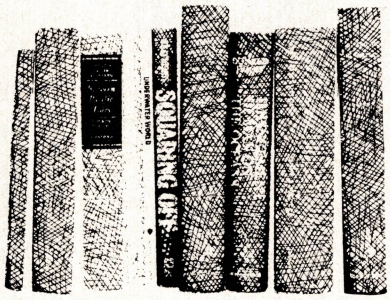

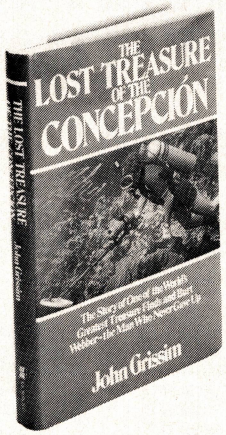

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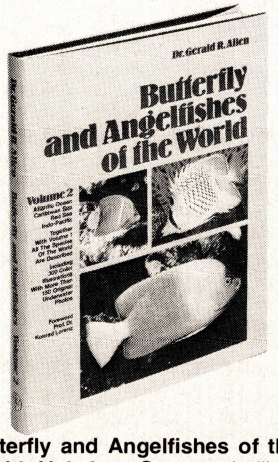

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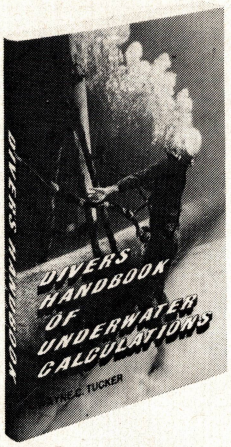
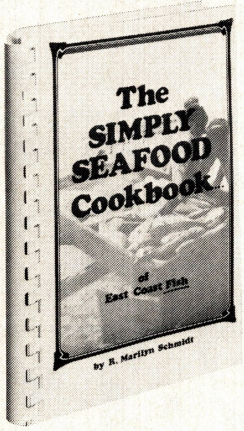
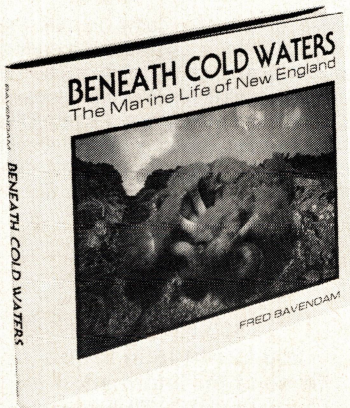


3 Diver's Handbook of Underwater Calculations — This work contains vital information on, and solutions to, problems from buoyancy to salvage. Presented in sections, each with its own equations and sample problems. $10. From Cornell Maritime Press Inc., P.O. Box 456, Centreville, MD 21617.



4 The Simply Seafood Cookbook of East Coast Fish — This collection of excellent recipes is divided into sections by the types of fin fish found in the waters of the eastern U.S. Each fish is described and the proper method of preparing it is given. $7.95. From Barnegat Light Press, Box 305, Barnegat Light, NJ 08006.



5 Beneath Cold Waters — The common species of marine life (from plankton to fish) found in the Gulf of Maine are described and shown in impressively clear color photographs. Common and scientific names are included with each species description. $18.95. Down East Books, Camden, Maine.

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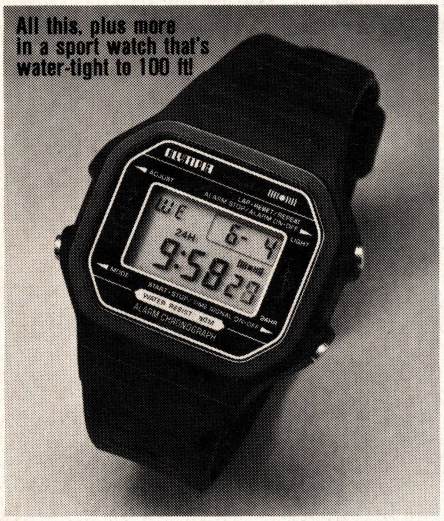

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EVOLUTION

(Continued from Page 78)

only slightly more mobile than the larger diving bells — both had to be suspended from, and maneuvered by their support ships.

At the beginning of the 19th century, the quest for deeper dives, longer bottom times and more freedom underwater made a big step closer to reality with the development of the air pump, or compressor. By 1828, two brothers, John and Charles Deane, modified a piece of fireman's apparel into a dive suit, the predecessor of today's deep-sea diving dress. Called "Deane's Patent Diving Dress," this outfit consisted of a helmet with viewing ports and a connection for air hoses with surface supplied air and a heavy suit which provided some thermal protection. Unfortunately, the helmet merely rested on the diver's shoulders, and was not sealed to the rest of the suit. No problem, until the diver leaned over or fell down — then the helmet flooded. With no air and the loss of buoyancy the diver probably had some difficulty standing up. By 1840, this problem was solved when Augustus Siebe introduced his completely enclosed full-length, waterproof suit. This "Siebe's Improved Diving Dress" became the standard of the industry.

By now (mid 19th century), man was able to go deeper and stay longer than ever before, but still the dream of freedom, of independence from any tethers to the surface, had not been realized. In 1825, W. H. James, an Englishman, designed a dive suit with its own compressed air reservoir, essentially as a rescue device should surface supplied air be cut off. It would not have provided air very long, because the volume of the reservoir was small and once turned on, the air just free-flowed, with most of it being wasted.

Then in 1866, a Frenchman by the name of Renoist Rouquayrol made a significant contribution to the advance of scuba. He and a friend called Denoyrouse, developed the first demand regulator which, "adjusted the flow of air from the tank to meet the breathing and pressure requirements of the diver." This unit was soon adapted to use with surface supplied dive systems because air tanks which could contain the high pressure air required for scuba had not yet been built. A few years later, in 1878, H. A. Fleuss developed the first practical scuba system commercially available. This system was a closed scuba system — a rebreather. By using 100 percent oxygen, and recirculating the gas in a closed loop, high pressure tanks were not required. A drawback to the system was that by using pure oxygen the maximum safe depth of opera-

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tion was 25 feet. Even with this limitation, the Fleuss closed circuit unit was improved over the years by the military of several countries, becoming quite sophisticated by World War II.

Interest was renewed in open circuit scuba in 1933, when a French naval officer, Commander Le Prieur, assembled a manually controlled regulator on a compressed air tank (tanks by then were capable of containing air at reasonably high pressure). Although this system worked, it did not meet with very wide acceptance; too much attention had to be paid to the opening and closing of a valve by hand, just to be able to breathe. The successful development of open circuit scuba had to wait another ten years.

Finally, finally! After some 5000 years in man's quest to dive untethered to greater depths, and not be limited to merely the air in his lungs, it happened! The year was 1943; the place was a small Mediterranean village under German occupation; the men were Captain Jacques-Yves Cousteau, a naval officer, and Emile Gagnon, an engineer. Together they developed an improved version of the Rouquayrol demand regulator and combined this with a high pressure air tank to create the first, safe, efficient, open circuit scuba. Within a short time, Captain Cousteau had used his new scuba system, called the Aqua-Lung, to successfully dive to a depth of 180 feet. Soon after the war ended the Aqua-Lung was being made and sold commercially. By 1948, all of a dozen Aqua-Lung units were imported for sale in the United States. Can you imagine that? We waited for over 5000 years for such an invention, and when it finally came, we only bought 12!

By 1949 to 1950 the Aqua-Lung was being sold by its first U.S. dealer, Rene's Sporting Goods, in West Los Angeles. In the 1950's changes were taking place rapidly as the sport grew in popularity. Rene's expanded its dive equipment line, and later it developed into one of the big names in the diving world, U.S. Divers.

Innovations in regulator designs appeared with the introduction of the first regulator reserve mechanism, the first rotating mouthpiece, the first regulator parts made of plastic, and the first single hose regulators. Even do-it-yourselfers got involved. In 1954, Popular Science published an article on how to build your own regulator from war surplus parts. Fortunately, for their owner's sake, these early homemade regulators were short-lived, literally! It seems they only lasted from two to three months before they froze up internally from corrosion.

As a sport, scuba diving is quite young, but some of our equipment, especially our regulators, are rooted deeply in the past.

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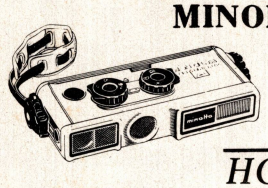

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BRING 'EM BACK EMPTY!

BY CHERYL PRICE

A shell collector can truly be proud of a collection that consists of previously vacated specimens for which the bottom has been scoured. I'm not discussing a collection consisting of semi-identifiable beach-worn lumps of limestone, but shells equal to their living counterparts. And, a diver has the advantage of finding shells before they make the trip through the surf zone to the beach.

Leaving living shells alone does not necessarily restrict your collection to second choice specimens. A live cowry has an all or nearly all-encompassing mantle that almost guarantees the shell to be smooth and glossy, but cowries are an exception in the shelled-gastropod group. Most genera are only partially protected by their mantles and can have growths of algae, tubeworms, coral, etc., residing on the shell's surface while they are still alive.

Remember, just taking a perfect live shell does not ensure a good display specimen. Although both live and dead shells can require external cleaning, live shells demand prompt removal of the animal and that usually entails some combination of boiling, soaking, probing, scraping, burying or freezing. This can produce cracks, clouding, chipped edges, etc.

Hunt for dead shells the same way you would for live shells. Knowing a bit about their habitat and habits is a definite advantage. For example, cowries are nocturnal feeders and usually reside under ledges, or in cracks and crevices during the daylight hours, making them difficult to find. At night they venture forth to feed and this is when they usually fall victim to another night feeder. Thus, empty shells are commonly found where they've fallen off the edge of a reef or in a depression on the surface of a reef.

Cones, conch, whelks and others that are sub-surface dwellers can also be located along the bottom edge of a reef or ledge where surge, tides, etc., have swept their shells from the sandy plateaus. Any depressed area in a sandy inter-reef plain is a prime site for the above mentioned forces to gather a collection of dead shells.

A shoreline dive spot with a stair-stepped slope usually has a collection of shells at the base of each step where currents can't lift them up to the next step. In general, shells found in this type of situation will be somewhat more worn. But, heavy non-glossy shells can

survive the ride in displayable condition.

In temperate seas, large rocks form collection sites similar to the reefs of tropical seas. Small abalone and other species that have fallen victim to predators such as starfish tend to end up at the bases of rock formations or under ledges.

Being familiar with the types of shells to be found in a certain area makes them easier to find. The flaring pink lip of a queen conch is easy to pick out, but a green and brown algae covered "rock" of the same size in that area is worth investigating too. Most often a spot of color, unusual geometric shape or outline cues the experienced eye to investigate further.

Once you find some shells follow through and make them look their best and retain their beauty. Even those shells needing only a rinse should be rubbed with a drop or two of oil to improve and/or retain their finish and color. This oiling can make excellent specimens out of shells that appear to have a whitish clouding over their surface, or otherwise slightly faded colors. Either mineral oil, glycerin, or even baby oil are suitable. Smooth shells just need a bit of polishing with a slightly oily cloth. Roughly textured shells or those with the brownish, skin-like periostracum need a few drops of oil dripped on their highest points and allowed to soak down the shell for several hours.

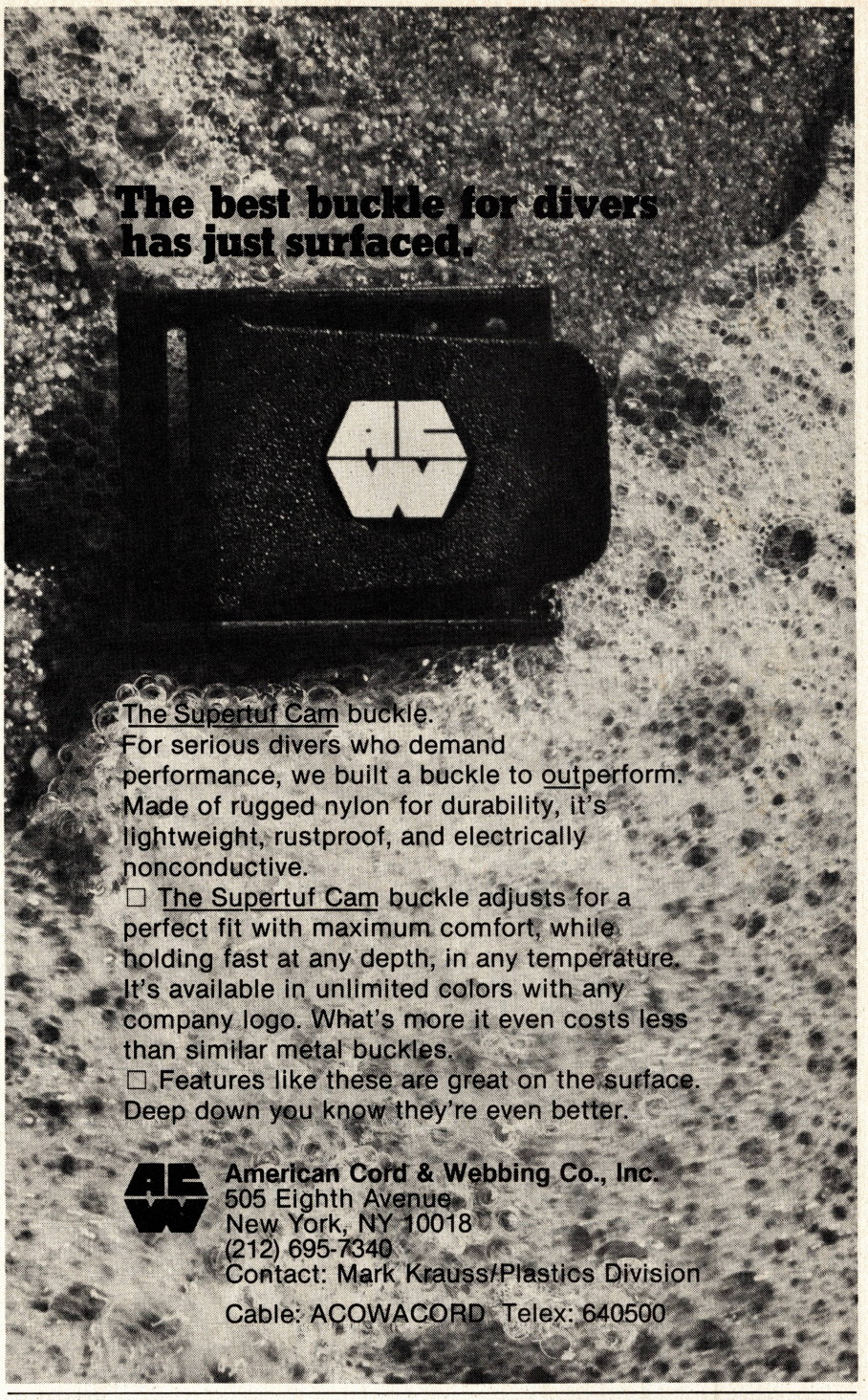
Surface algae, worm tubes constructed of sand, and similarly loosely attached marine growths can be best removed by scrubbing with a brush.

A knife or ice pick can be useful in popping off stubborn barnacles, oyster starts, or tubeworms. A knife with a serated edge can be used to scrape or file off growths of pink coraline algae, if damage is not extensive.

A little chlorine bleach diluted to one-half strength with water will sometimes soak off algae stains. Don't leave shells in bleach solution for more than a few minutes. Prolonged soaking of some species causes a white haze to form on the shell's surface. Rinse and rescrub the shell after soaking.

Several common shells are even desirable if worn or damaged. Abalone, tops and turbans are among these. Underneath their rough outer surfaces are mother-of-pearl layers. To expose these use muriatic acid (usually sold in drug stores). Apply with an old brush or dip small shells directly in the acid. Continue applications every five minutes to a half hour until the desired amount of pearl is exposed.

Above all, don't become discouraged too quickly if your favorite dive site doesn't yield instant treasures. Shells, dead or alive, can be elusive and not all will clean up to be coffee table centerpieces.



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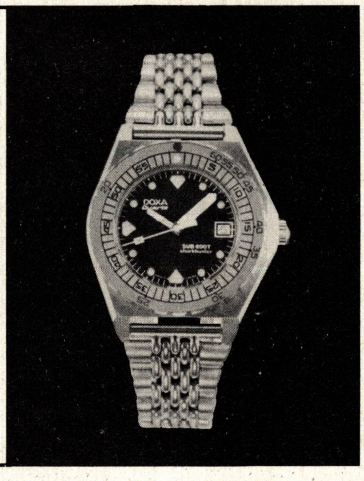

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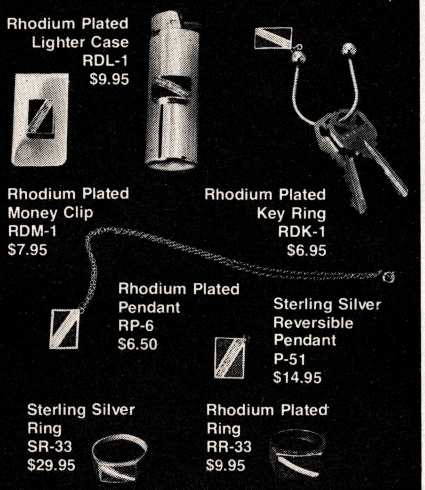

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VIDEOTAPES BECOME USEFUL MARINE TOOL

BY MICHAEL J. GANAS

As the crane cable rises vertically from the sea, drawing with it a 40 foot cradle-back, we prepare to send our own diver over the side. In another moment, the construction diver who had laid the last section of pipe emerges from the water, climbing slowly up onto the dive platform that extends horizontally from the side of the 300 foot long jack-up barge, the *Alice G. Neuman*.

A familiar voice beckons over our vessel's radio. "*Alice G. Neuman* to the *Glen Miller*!"

I depress the transmit button. "This is the *Glen Miller*!"

"It's all clear, you can send your diver down."

"That's a copy. *Glen Miller* clear."

I signal the tender and he gives the pull-cord on the diesel-powered air compressor a hefty tug. The compressor roars to life, deafening us with its loud clatter. A minute later, Jim Curry, wearing a DM-7 Aquadine hardhat and holding a CCTV camera, jumps from the stern of our 42 foot crew boat tied alongside the *Neuman*. He descends on the pipeline.

I enter the vessel's cabin, leaving most of the noise outside, and put on a pair of headphones. The rise and fall of the diver's breathing can be heard. Mike Ritenour, another diver, is already monitoring the videotape console. He flicks the toggle switch that activates the TV system and ten seconds later the picture screen lights up.

Suddenly the diver's voice reaches us from a depth of 42 feet. "On the pipe . . . slack the diver," he says, sounding like Jerry Lewis, the confines of the Aquadine helmet altering his vocal tone.

"Slacking the diver!" Mike responds.

The tender, who is also monitoring the conversation via a loudspeaker on the boat's deck, feeds more umbilical air hose into the water.

"On the joint!" Jimmy informs us.

Although the underwater visibility is poor, less than a foot, we receive a clear picture of the pressure fitting plug on the right side of the video screen.

"Pan right!" Mike instructs Jimmy.

The plug moves to the center of the screen. We are now ready to record visual as well as audio information. I suddenly feel like we are about to give our 86th performance in a long running Broadway play. Actually, we were going to videotape the 86th joint along with the cathodic protection on the Ocean City Outfall under construction. This was the method of documentation used to verify the contractor's compliance with the

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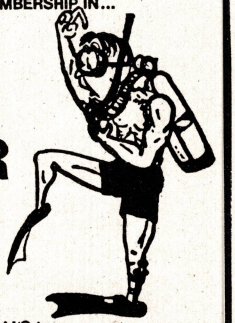

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project plans and specifications and to check for damage. We had our inspection format, including technical language, down to a routine science.

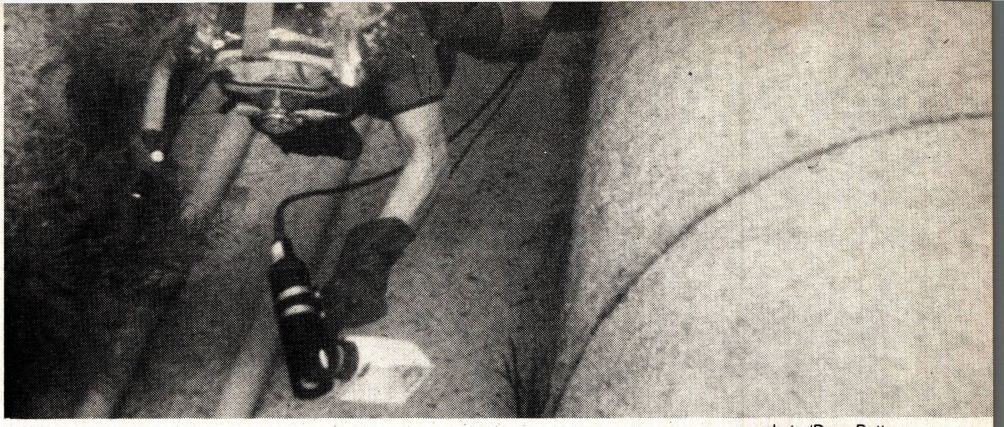
"Stand by to go on record!" Mike cues the diver. "Three . . . two . . . one." He flicks the record switch on the console and the twin eight track reels begin to rotate.

I hold up the paper with the identifying information for Mike to read into the tape. "This is an inspection of joint 86 at station 72 plus 20. Go ahead diver, what have you got?"

Changing forms begin to move across the picture screen as Jimmy goes through his inspection procedure. Earlier today, we had discovered a damaged pipe bell with exposed reinforcing wire that needed to be repaired and a parted cathodic wire that had to be re-crimped. We were a team that was effective in the way of quality control.

Closed-circuit television, commonly referred to as CCTV, has become an extremely useful tool within the marine construction industry during the last ten years. The demand for underwater CCTV services has become so great that virtually every well-established dive contractor and even some less well known are outfitted with at least one fully operational system.

CCTV is an excellent means for topside, non-diving personnel, such as engineers, environmentalists and insurance people, to assess submarine damage or to take underwater surveys. Videotape recording features are common to most units on the market and will allow high echelon individuals in government and industry to review subaqueous findings at a remote location thousands of miles from the actual dive site.



photo/Dave Dutton

Although one may assume that videotape techniques are relatively simple, requiring little or no skill on the diver's part in aiming a camera, there is really a variety of problems associated with underwater CCTV inspection work. One of the most common is an erratic picture caused by a diver's unsteady hand. A hand-held CCTV camera must be moved smoothly during a scan and directed on assigned areas without jerking it, otherwise it is almost impossible to convey what the diver is seeing in the form of a clear video picture. Sometimes currents and undersea surge will make it difficult for even the most experienced diver to keep the camera from wavering.

Off-centered and tilted pictures are two more problems. Oftentimes a diver will hold his camera off to one side or cock it as much as 90 degrees, disorienting viewers and interfering with their perception of the visual data. More than once I have seen topside personnel shift their heads in order to compensate for a tilted picture. To avoid this, it is important that the CCTV technician monitoring the videotape console direct the movements of his diver.

Inspections carried out in the immediate vicinity of construction activities are generally hampered by zero or near zero visibility. Because of this, CCTV units such as the Kinergetics Observer II have been developed with a camera lens more sensitive than the human eye, often en-

skin diver

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MARINE VIDEOTAPES

abling topside personnel to witness what the diver could not. In such cases, a diver has no way of knowing if his camera is on target unless he is informed by the technician. Generally, a diver's videotape inspection is only as good as his topside support.

Another problem that frequently occurs during the course of videotaping is a diver's umbilical hose becoming snagged or hung up on a submerged object, thus restricting the diver's movements. When this happens, it is important that the diver inform the technician in order to stop recording while he frees his hose. Personnel viewing the tapes should not have to be subjected to a picture jumping every which way while a diver retraces his line, nor should they have to listen to his complaints while he clears his ears.

Topside circumstances that can interrupt a videotape inspection, such as a malfunctioning compressor or intermittent audio communications, are other common problems that often confront an inspection team. When situations such as these arise, the technician should cease recording and notify the diver he has done so, either by direct communication or by prearranged line signals. After the problem is rectified, the diver can commence recording where he left off. Thus, while there were holdups during the actual videotaping, a replay of the tape should show no discontinuities or distracting elements.

Performing a CCTV inspection on a submarine pipeline under construction can be especially difficult due to the multitude of hazards that can jeopardize a diver's safety. Tugboats and smaller vessels seem to be in constant motion around a pipe lay barge. Dredging may be taking place one pipe section ahead while a joint inspection is in progress. A crane sometimes swings a heavy load out over the water unexpectedly. Things of this nature seem to continually plague a videotape inspection.

As in the case of the Ocean City Outfall Project, we had to be constantly aware of potentially dangerous events developing above and around the vicinity of our diver. Careful judgement had to be exercised before deciding to pull the diver up and halting an inspection. Even though we were to inspect, we were to avoid holding up the contractor's production unless absolutely necessary. Because it was not unusual for signals to become crossed with the builder, continuous radio communication was a critical safety requirement.

Without warning, the tug *Robert J. Casho* came charging around the side of the *Neuman,* pushing a loaded stone

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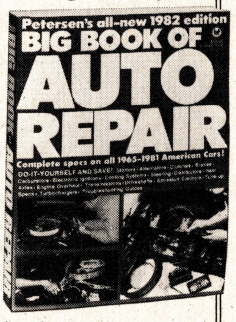

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barge. Grabbing the radio's microphone I spoke quickly.

"*Glen Miller* to the *Casho!*"

"This is the *Casho, Glen Miller.*"

"We have a diver in the water!" Although I was certain that the tug operator probably already knew this, it never hurt to check on his intentions anyway. One could never be too careful on this kind of operation. Many an accident has occurred as a result of careless assumptions.

"That's a roger, *Glen Miller,* I'll keep clear of you."

A minute later, a crane on the deck of the pipe lay barge began to swing a 60 foot section of pipe over the water, 60 feet away from our diver. Mike Ritenour did not hesitate to go off record.

"All stop!" he spoke sharply into the intercom. "Move west about 50 feet . . . they're slinging a pipe over the water."

Should a cable part, it was possible that a 30 ton pipe could plane its way laterally as well as vertically upon plunging into the sea, thus ending up on the head of a diver 60 feet away.

"Roger that," Jimmy replied. The tender could be seen pulling hose back onto the deck.

When the danger had passed two minutes later, Jimmy was instructed to go back to the area he had last inspected and videotaping once again resumed.

Of course, when visibility drops to absolute zero, it is impossible for even the most sensitive CCTV cameras to produce a picture. And although the underwater visibility on this particular project averaged about six inches, there were instances where only audio information could be recorded onto a tape, the diver doing his inspection by feel.

Not all CCTV inspections are performed in murky water. Occasionally a dive contractor may be called upon to inspect an existing pipeline or ship's hull stationed in clear southern waters. Inspections of this sort do not present the complexities and risk factors common to marine construction sites.

One videotape inspection, in particular, occurred on a subaqueous crude oil pipeline off East End, Grand Bahama where Hurricane David had left minor damages in its wake. The CCTV inspection team found the underwater visibility to be nearly 100 feet. Water transparency of this magnitude enabled the diver to scan the pipeline from a distance of 40 feet, giving a panoramic view and overall perspective of a damaged area before moving closer for a more detailed survey. The videotape playback that resulted provided some oil company executives with a visual display of such clarity that it was difficult to tell that the tape was produced underwater.

All in all, CCTV has become an important tool within the commercial diving industry and is another subject a commercial diver must be familiar with if he/she is to be productive in this field.

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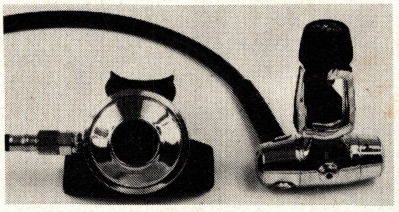

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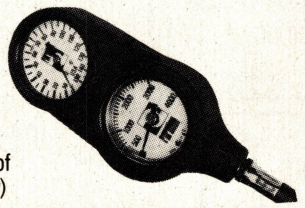

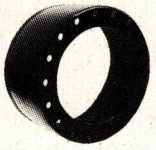

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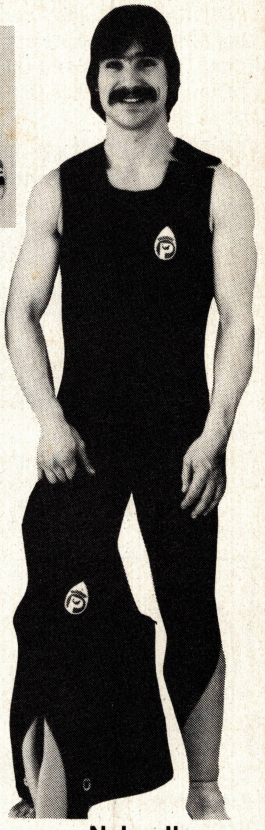

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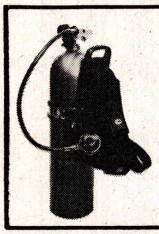

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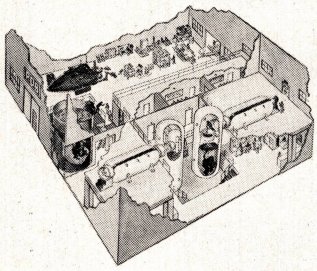
PDSNY OPENS HYPERBARIC CENTER

Professional Diving School of New York has opened a new facility to train commercial and advanced sport divers with equipment used by the U.S. Navy. International Underwater Contractors purchased the Navy's hyperbaric chamber systems for use by its subsidiary, and has established a new division known as the North American Hyperbaric Center.

The Hyperbaric Center offers a program of bell diver and life support technician training in conjunction with PDSNY's regular deep sea diver training course. The Hyperbaric Center chambers were formerly a part of the Navy's Experimental Diving Unit in Washington, D.C. and were used to develop the Navy's decompression tables and train first class and master divers. The equipment was sold to IUC when the Unit relocated to Panama City, FL, and built new chambers there.



The Professional Diving School's North American Hyperbaric Center is located on the grounds of IUC at 222 Fordham Street, City Island, New York City, on the shores of Long Island Sound. For information call: Gary Parsons (212) 885-0600.

IQ-12 IN TORONTO

The International Conference on Underwater Education (IQ-12) will be held November 13, 14 and 15 in Toronto, Canada at the Skyline Hotel.

In addition to exhibits by trade, tourism and dive organizations, there will be two film nights featuring three top film personalities. On Friday evening, John Stoneman teams up with Jean-Michel Cousteau. Stoneman has just completed a marine environmental film documentary entitled *Defenders of the Sea* which will be shown at the conference. On Saturday, Stan Waterman will entertain with his superlative collection of underwater footage.

The conference program will feature well-known speakers dealing with many current topics and issues. At the Awards Luncheon, individuals from several countries who have contributed to diving will be honored.

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VIKING SUIT

(Continued from Page 15)

(if one cares to) by wearing gauntlet style gloves.

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The neck seal must be folded downward. While water won't enter if this isn't done, air will leak out.

The care of the Viking Sport is simple. Rinse the suit in fresh water, paying special attention to the zipper and valves. If it gets damp inside, dry it thoroughly. Store the suit away from sunlight, rolled up in the bag provided. The zipper should be lubricated with parafin wax as necessary. Silicone spray should not be used. A bar of wax and a patching kit are provided with each suit. If a latex cuff, hood or neck seal should be torn, replacement parts and cement (never use neoprene cement) are available at low cost. The repair can be done at home by a knowledgeable repairperson, or at the nearest Viking retailer.

The Viking Sport is produced by Viking Stavanger AS of Norway. This company's years of experience with cold-water diving and drysuits shows in this suit — it works.

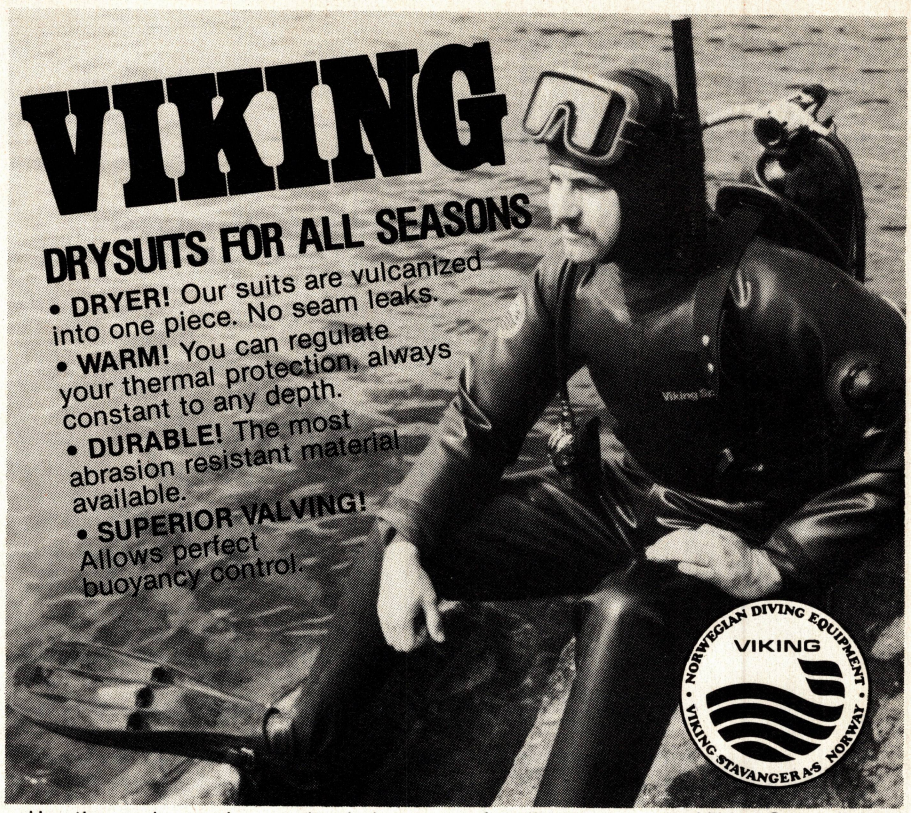
The Viking Sport costs $621 and the thermal underwear is $146.50. The suit comes in black only, in four sizes, to fit divers from 5'6" to 6'5" tall.

For information on the nearest Viking retailer, contact: Viking Technical Rubber, Diving Division, P.O. Box 8236, New Haven, CT 06530; (203) 933-6744.

WORLD RECORD ALTITUDE DIVE

On Sunday, August 9, 1981 a new world record in high altitude scuba diving was set, by divers Ralph C. Weeks and Thomas P. Christian. The unnamed lake at 13,420 feet above mean sea level is located six miles southwest of Breckenridge, Colorado.

Weeks is a first-year graduate student in planetary sciences at the Lunar and Planetary Laboratory of the University of Arizona. Christian is a junior in engineering and applied science at the California Institute of Technology. The dive required a three mile hike from road's end with an elevation gain of 2500 feet. The lake itself is clear and has a glacier/snowpack sliding into one end. It measures 1000 by 800 feet. The depth is estimated at 20 feet.



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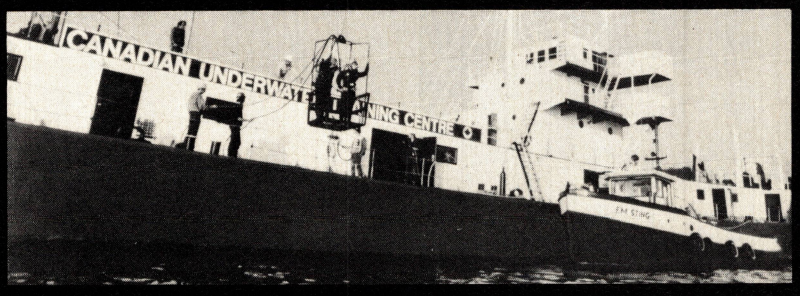

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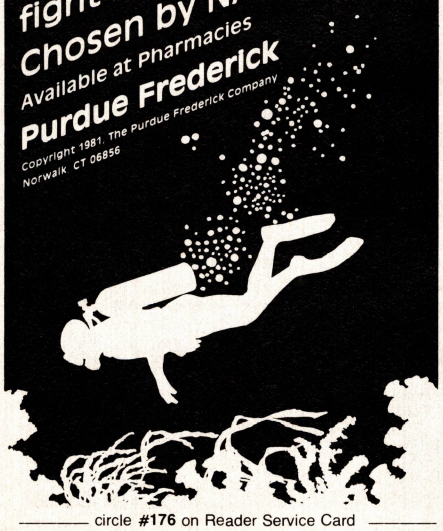

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AMISTAD
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TEXT AND PHOTOGRAPHY BY VESTA REA-SALISBURY

It sits like an oasis among the sparse vegetation of catclaw, ocotillo, yucca, blackbrush, leatherplant and various cacti. Its appearance is soft and inviting when compared to the stark high desert topography which surrounds it. It has a special allurement — one that draws you to its steep limestone banks, begs you to enter the translucent water and then caresses your sense of wonderment. Its 86,000 acres stretch endlessly, flowing past the U.S. boundary lines into Mexico — up and up it goes in a lazy L configuration along the impounded Rio Grande. Its name rolls from your tongue as easily as the water mesmerizes your body — Amistad, Spanish for friendship, calls you to experience the excitement beneath its surface.

Amistad Reservoir, a National Park, is located 12 miles northwest of Del Rio, Texas, 576 miles above the mouth of the Rio Grande, and one mile below the confluence of the Devil's River. It was constructed a mere ten years ago by the United States and Mexico for $144,636,000. Territorially, it sits equally in the state of Texas and the Republic of Mexico. It was created for flood control, conservation and hydroelectric power; however, it has turned out to be the clearest and the most interesting scuba diving lake in the state and the center for recreational activities.

When I was invited by Rick Wadle, owner of Dive World in San Antonio, to join their group on an inland water dive of the Rio Grande and Amistad, I was skeptical. As a young child I'd recalled seeing this famous river near El Paso. At that particular spot, it was only about ten feet deep, with zero visibility. Since diving in mud has never been high on my priority list, I departed on this adventure with reservations. Rick, a personable gentleman in his 40's, was quick to reassure me that I would not be disappointed.

"You're not going to believe Amistad when you see it," he began. "It is as blue as indigo, as clear as rainwater, and as exciting as inland diving can get." As I listened to his enthusiastic dissertation, I recalled other story assignments on inland waters I'd been sent on. In those cases, the visibility had been less than desirable and the excitement had been created from shoreline stories told by seasoned divers from the areas who knew nothing better than feeling their way along mud bottoms. However, I decided I wasn't going to put a damper on

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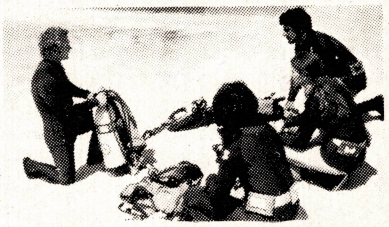

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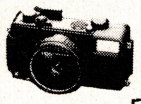

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Rick's enthusiasm — I'd wait and see for myself.

Getting to Amistad is not easy. Literally, it is nowhere from nowhere. The closest city of any size is San Antonio, and it is three hours away. Since a boat is advisable when diving Amistad, Rick trailered his 25 foot Wellcraft Cruiser, powered with twin 470 hp Mercurys. The boat was beautifully appointed with tank racks and plenty of storage area and it looked as if we were well set up for diving once we got there.

The terrain around historical Del Rio is slightly rolling; therefore when we topped a gentle rise in the road I was

not prepared for the vision below. Amistad lay before us like an ocean. Water was everywhere, accented with high-rising vertical cliffs. Rick had been right — the lake was indigo blue with clarity that was unbelievable. How could the dammed-up, muddy Rio Grande produce something so beautiful? Emery Lehnert, the National Park naturalist, answered my question.

"Amistad is extremely deep, with the reservoir being impounded in the canyon where the Devil's River and the Pecos flowed into the Rio Grande. This entire area is fed with hundreds of pure freshwater springs that have a constant temperature of 73°F. With the minor current in the lake and the constant flow of spring water, clarity is easily achieved." I was impressed and anxious to see what was below.

The Amistad project was built in an area where prehistoric man flourished about 8000 B.C.; where Spanish exploration took place in A.D.1535; and where some of the largest working ranches in Texas were located. With so much romantic human history, divers quickly realize they are going to discover some pretty unusual things.

Probably the most famous dive spot on the lake is called The Ranch. The site is a ten minute boat ride from Diablo East Marina across to Castil Canyon and Evan's

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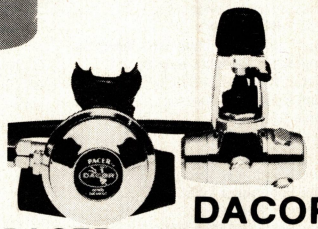

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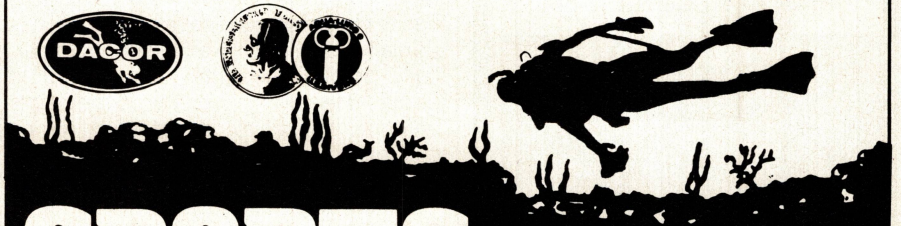

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AMISTAD

Creek. The dive takes place in about 35-40 feet of water with visibility approaching 30 feet. The Ranch consists of an actual hacienda, with a 20 foot tall palm tree still upright and solid in the garden, a bunkhouse and outhouse.

The second most popular area is a large cove at Diablo East, set aside strictly for diving. The National Park Service Diver's Workshop is held here every October with sportsmen coming from Louisiana, Arkansas, Oklahoma, New Mexico and Texas for advanced training. The cove has a sunken platform, an old boat and caves.

From Diablo East the adventuresome underwater explorer can head into San Pedro Canyon and dive on the old Highway 277 bridge, still completely intact at 30 feet. In the back fingers of the lake, visibility does drop considerably and caution would be advisable.

After San Pedro Bridge, one heads northeast and crosses two previously constructed dams that once made up Devil's Lake — the dams are now underwater and are respectively Walker Dam, directly opposite of Diamond Head Island; and Devil's Dam at Rough Canyon Marina. Oddly enough, if Amistad went dry there would still be a lake in the Rough Canyon area owing to these two old structures. Devil's Dam, a hydroelectric facility, lies in approximately 80 feet of water at its top and drops to 130 feet at the base. Visibility is marginal.

From Rough Canyon Marina the boat moves due north up Devil's River. This river, and its topography remind one of a miniature Grand Canyon. The east rock banks shoot 200 feet skyward. Deep crevasses and caves etch their way back through limestone that has been stained black and red by the harsh environment. It is a place where eagles nest. Chimney pinnacles on thin cave ledges appear suspended like candelabra tapers. This creates an excitement of discovery, particularly when the underwater explorer finds much the same thing below the surface. One cave at the water's edge is easily visible as you move upstream. It is partially above the water level and partially below. The entry goes down to about 40 feet with a width of 15 feet. After entering the cave, it appears as an eroded hole in the soft limestone overhang.

Seven miles up Devil's River from Rough Canyon Marina is Indian Springs. This spring is a favorite winter dive area with its constant 73 degree temperature and is a great spot for spearfishing. Fish congregate in the warm water like minnows in a bucket, allowing even the most inexperienced sportsman spearing success. Although it is only legal to spear

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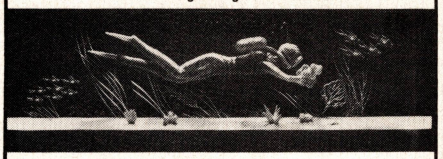

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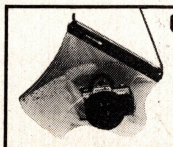

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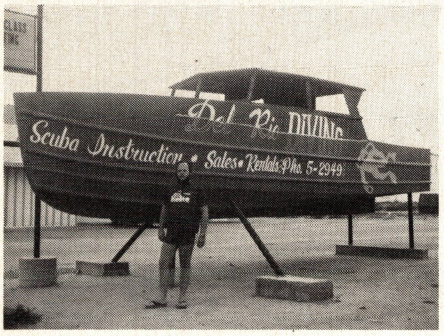
rough fish (gar, carp, shad, drum and catfish), there is one exception — the tilapia. The tilapia is an African perch which weighs up to six pounds. Since they are vegetarians, they can't be caught on a hook and line, making them fair game for spearfishermen. They make an excellent meal and are tough fighters.

Spearfishing is encouraged by the National Park Service, and if a club or shop wants to get a group together for a contest or outing, all that is required is a permit (free) from the park office and a Texas fishing license. The Park Service even goes one step further, notifying Mexican authorities, who send dump trucks over to collect the fish for food.

On the other hand, if you have a burning desire to spear game fish, then the Mexican part of Amistad is for you. Mexico has no spearing restrictions as long as you have a Mexican fishing license. However, fair warning should be given — do not enter the lake on the United States side, spear in Mexican waters and then return to the U.S. If you are caught with game fish in American territory, expect a serious fine. Mexican spearfishing should be conducted from Mexican docks and then cleared through normal customs procedures. This makes everything legal and protects you from a fine.

If excitement is all you crave from spearfishing, then rough fish in the United States should satisfy you. It is not uncommon to bag a 50 pound carp or a 100 pound gar, and if a catch like that isn't excitement, I don't know what is!



The one professional dive shop on Amistad is called Del Rio Diving and Salvage. It is a full-service operation owned by Larry Horn. Horn, a long-time resident of this area, has some favorite dive spots that are not normally visited. One is the Chupardsa Ranch located in Mexican waters at buoy 16, 13 miles northwest of the dam. This ranch, unlike the one at Evan's Creek, is a very ornate hacienda in about 15 feet of water. The once formal gardens are gone, but the magnificent lace-like, cement block fence still stands. Oval Moorish windows and porch entrance columns are there to swim through. Visibility approaches 40 feet as the divers lazily make their way around the grand house. An old high-chair lies resting in the mud and a child's tricycle leans against a doorway, creating an impression of sudden departure.

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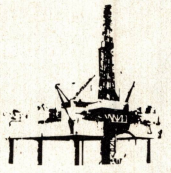

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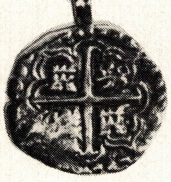

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AMISTAD

A lonely feeling engulfs the underwater intruder — a feeling of sadness for those who gave up their home for progress. Not far from the ranch are the remains of the lower structure of a windmill and cistern. Ironically, this windmill, which once kept the ranch alive, now sits in a watery grave like a monument to the land's forefathers.

One soon realizes that dive sites are nearly unlimited on Amistad. The old railroad constructed in the 1880's twists like a snake between the International Bridge and Ward's Point. Sitting now in varying depths, it was originally built by the labors of Mexicans, Italians, Irishmen and 3000 Chinese who were paid a meager $1.25 per day. A railroad tunnel near Diablo West is available for diving.

Archaeologically, Amistad is the treasure chest of the Texas border country. Over 300 known sites exist on the United States side of the reservoir basin and 63 sites are found on the Mexican side. These archaeological finds, both above and below the water level, capture an Indian culture dating back 10,000 years. Some of the most famous sites are located in the upper Pecos River in Seminole Canyon. Here caves so large that 100 people could live in them can be found, and pictographs cover the walls. The cave murals in the area around the Pecos-Rio Grande confluence combine color, form and composition in a highly developed art style which probably has few parallels in the new world. Amistad, in terms of pictographs, is one of the richest localities known to man.

Further up the river is Bonfire Rockshelter and Bison Jump. At this location, prehistoric Indians killed the great bison by driving them over the slope and then butchering them in the area where they were impaled. As for historic times, the area was the home of the Apache, and much of this tribe's past is still available for discovery. Since Amistad is a Federal Reservation, any artifact uncovered by the diver falls under the Federal Antiquities Law. However, outside of the National Park and particularly on the rivers, the only thing a diver needs to have to "pot hunt" is written permission from the landowners.

Amistad is one of the country's few inland lakes which a diver can never grow tired of. Exploration of its warm water is unlimited, and the beauty of the surrounding topography is unforgettable. The romance of old Mexico hangs in the air, and the sunsets turn the sky a brilliant orange. The name rolls from one's tongue as easily as the water mesmerizes the senses — Amistad, Spanish for friendship, calls you to experience the excitement beneath its surface.

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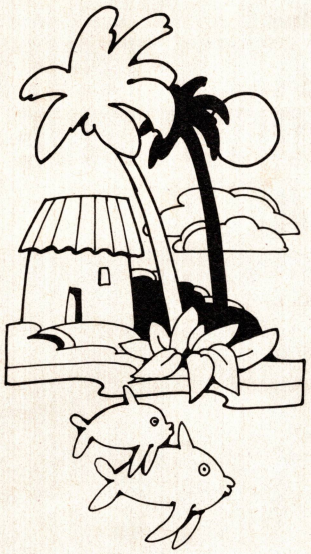

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   1 ☐ Cash 4 ☐ Mastercard/charge 7 ☐ Other
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   3 ☐ Air Travel Card 6 ☐ American Express
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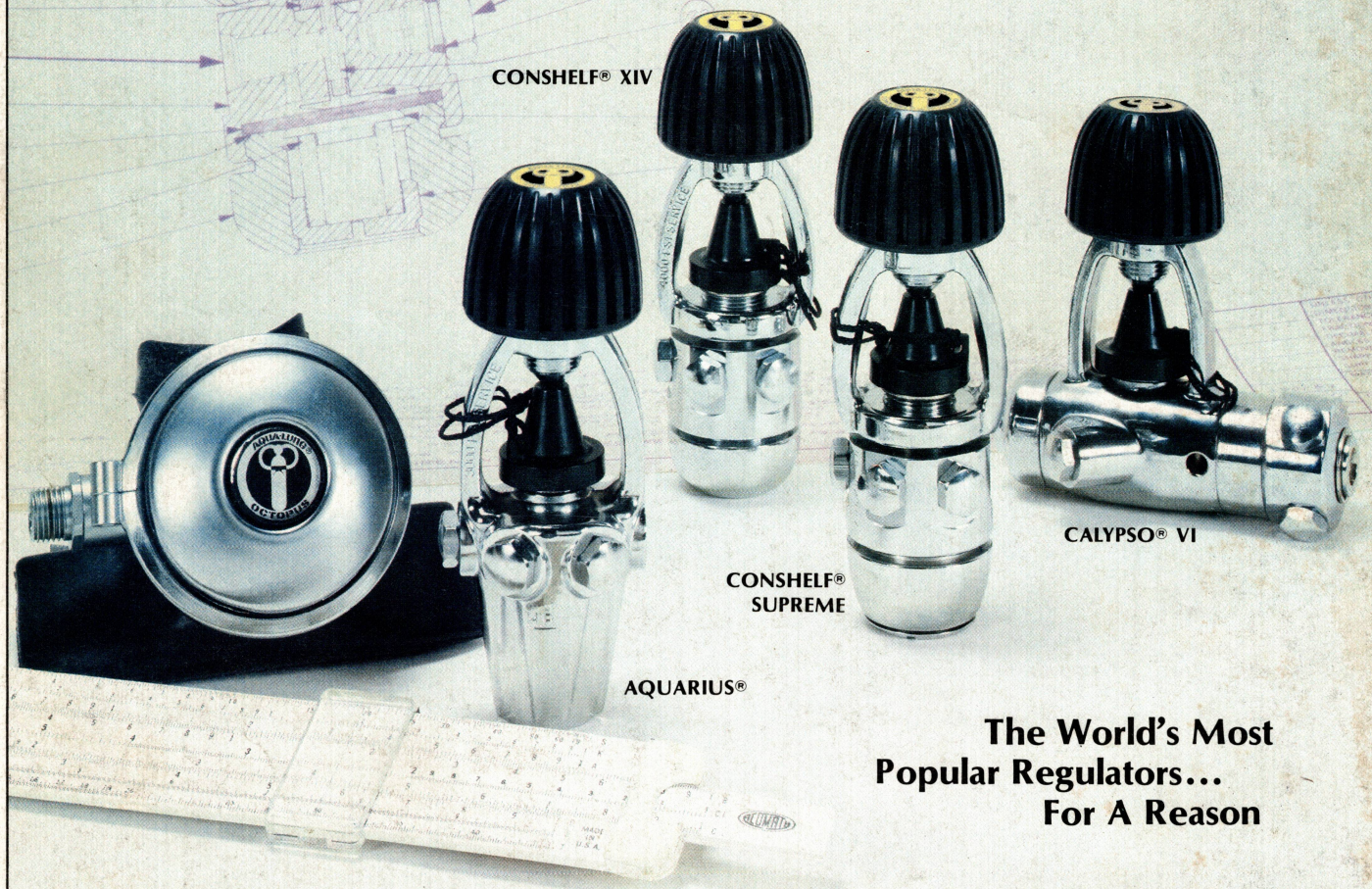

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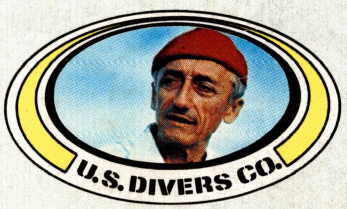

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